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MARCH 11, 1960

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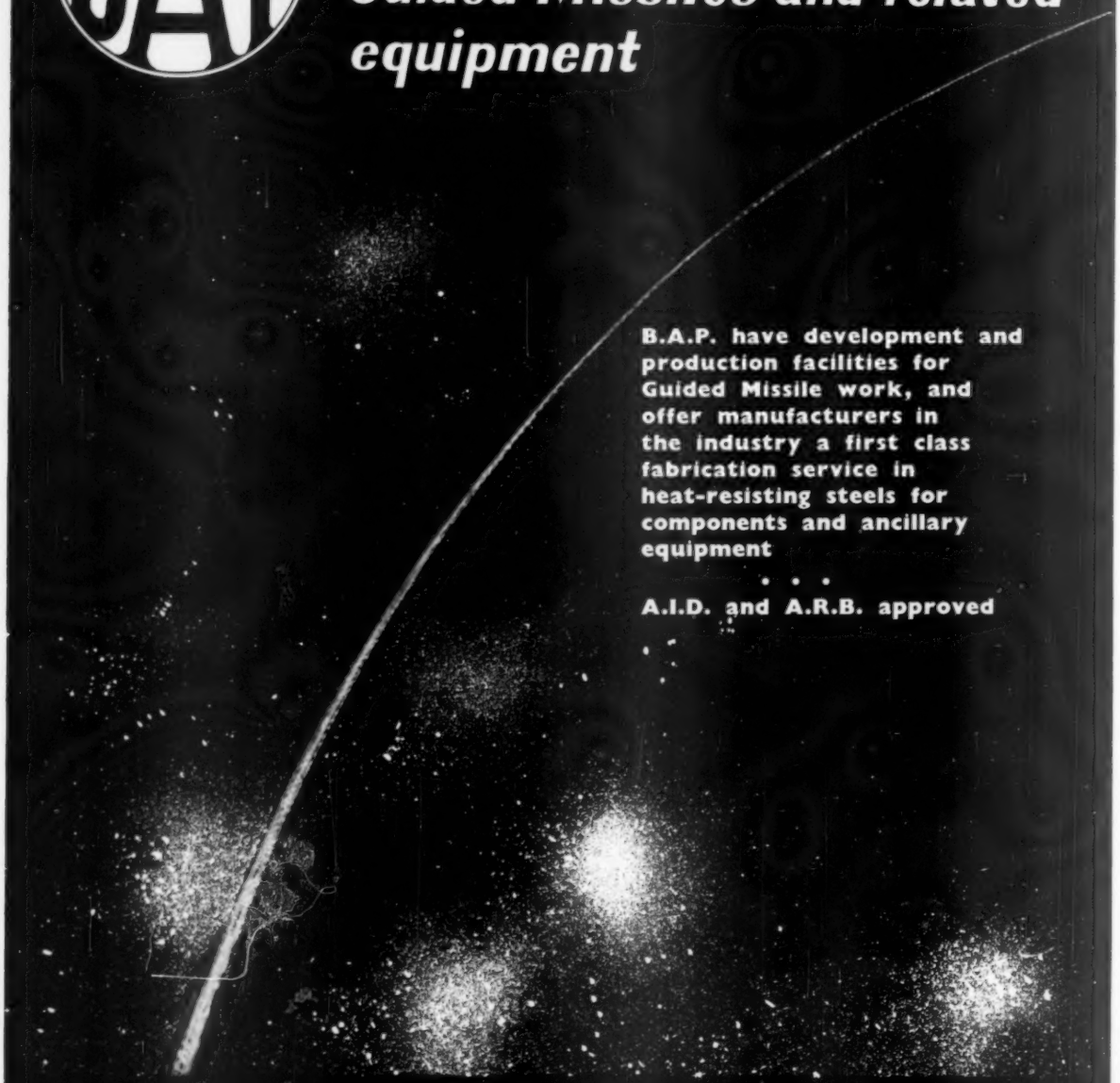

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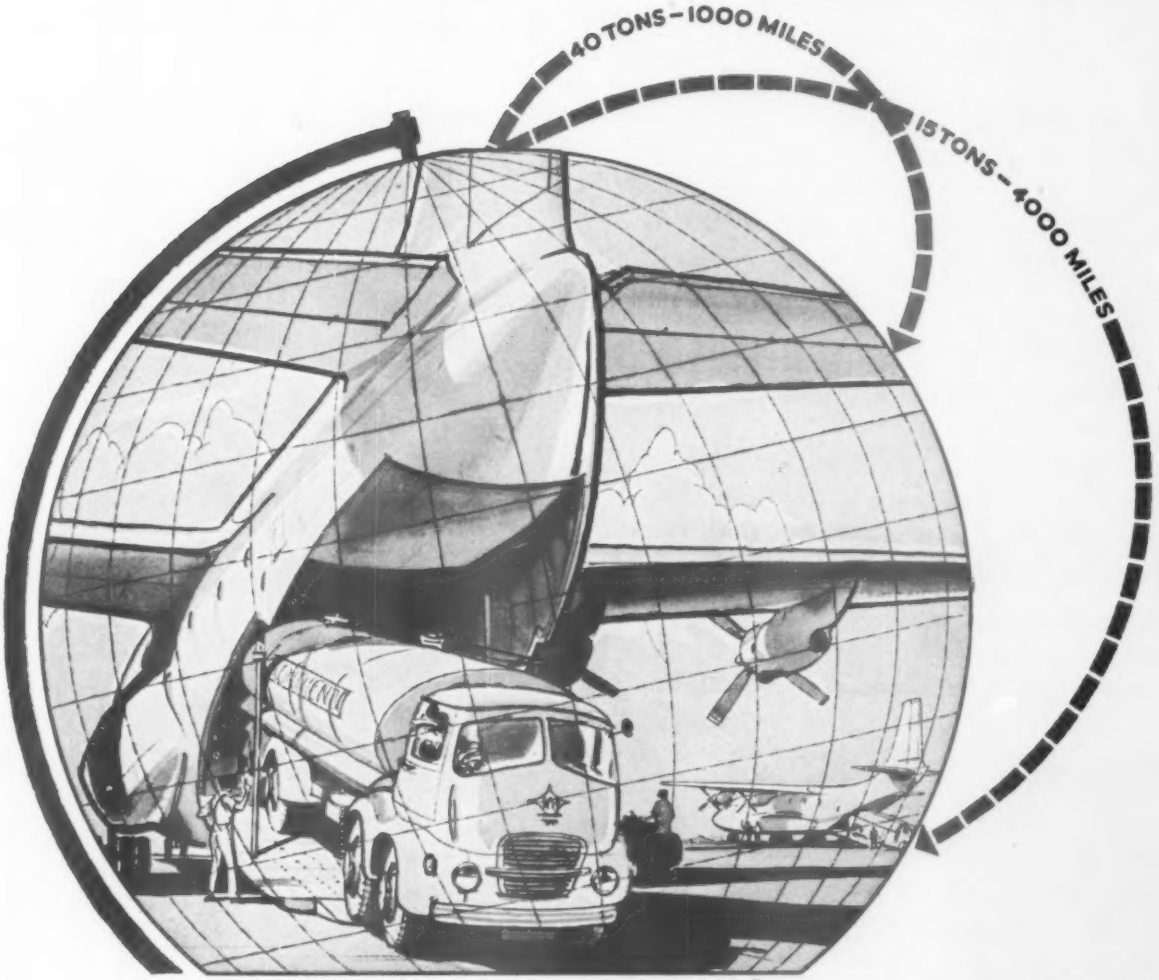

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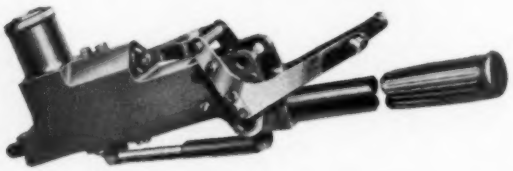

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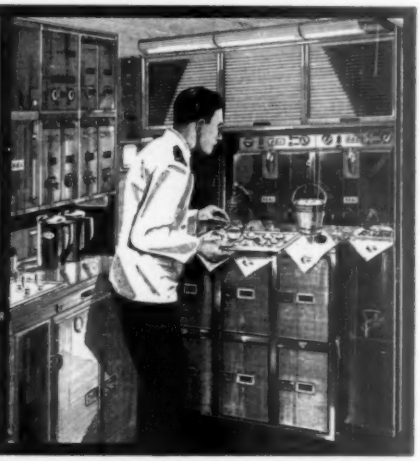

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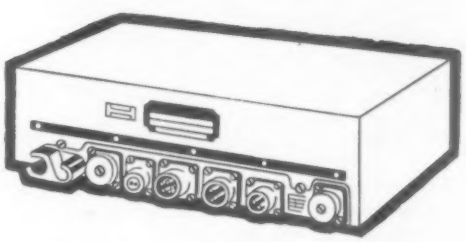

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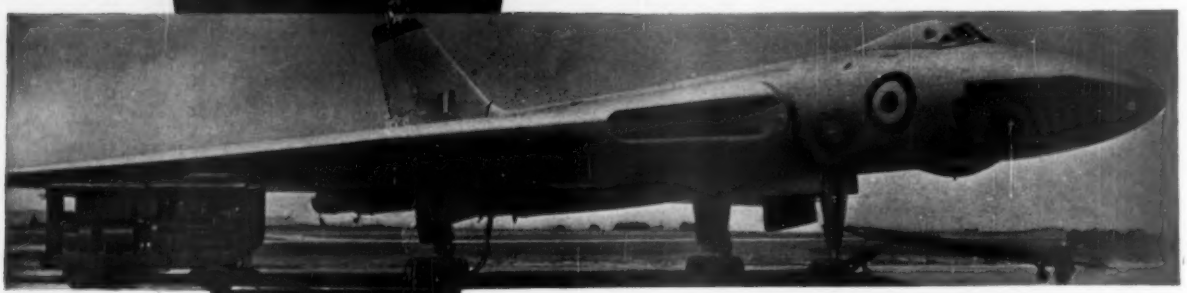

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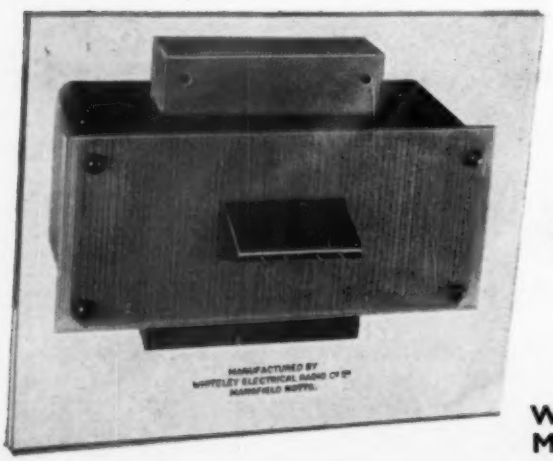

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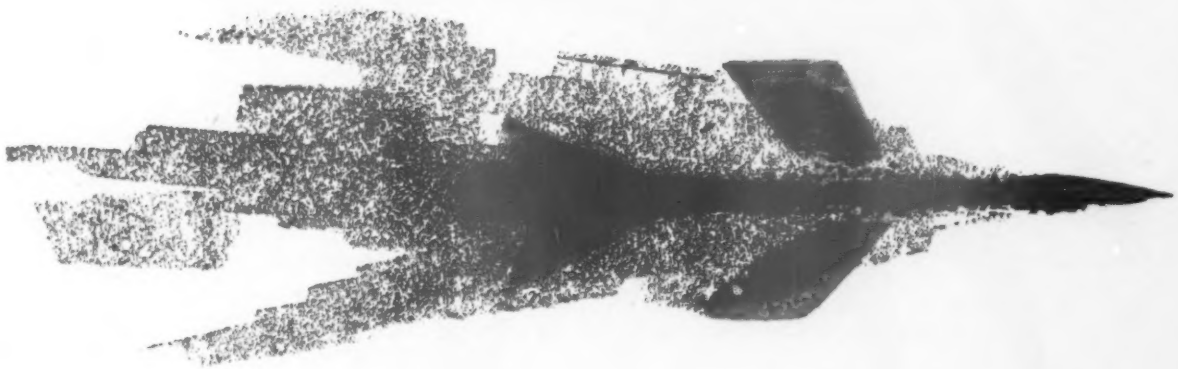

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2525 MARCH 11, 1960

Back to Orthodoxy

We suppose that it may well take four solid hours' reading to peruse the two volumes of Hansard containing the report of last week's debate on Defence. For this reason we do not expect that all the weighty words uttered by members of the three parties will be widely examined. In these days most people expect to be sufficiently well informed about all matters of moment after scanning the daily papers for 30 minutes or so at breakfast and afterwards on the way to the office.

We are not sure one particular point came out very strongly in the newspapers, but what seemed to us to be significant was the widely accepted view by members of the House of Commons that it is not enough to have the deterrent, one has got to have adequate conventional forces as well. Of course, there are those who think that it would be much better to leave the deterrent to the Americans but those who argue that way insist we must still be adequately armed with conventional forces. This kind of outlook is reflected in thinking about the Royal Air Force. There was a time when it was going to be all automatic, push-button and guided missiles. But today the idea is to use air-launched ballistic missiles which may be carried by aircraft designed to combine the rôles of bomber and transport.

Of course, to a specialist in aviation affairs it is remarkable how seldom in these discussions sufficient attention is paid to the time factor or to the problems of developing a new idea. This aspect is particularly to be noted in the discussions now raging regarding the relevant merits of Blue Streak which has still to be fired, compared with those of still embryo Polaris. It is extraordinary how the non-existent Skybolt is accepted as being the immediate answer to everyone's problems.

One point seems to have been overlooked by all speakers and that is that if we were to scrap Blue Streak we should have no means of launching satellites, and as Mr. Watkinson has disclosed, his Ministry is now looking into the defence aspects of space research.

Flying-boats and the ALBM

Just at this time when much discussion is taking place about the air launching of ballistic missiles we have heard from Air Vice-Marshal Don Bennett that he has been forced to give up the idea of buying the Princess flying-boats from the Government. He has regretfully had to drop the idea of putting these three flying-boats into commercial operation as he has failed to obtain any decision from the authorities. If they were to be equipped with Rolls-Royce Tyne engines, these boats would, in the Air Marshal's opinion, be a wonderful proposition. He certainly ought to know since he was involved in the operation of flying-boats before the War.

It so happened that these boats could be spotted from the air during our return from South America on Christmas Eve by Comet. The irony of this was that on the River Plate Short Sandringham flying-boats are operating a city centre-to-centre service between Buenos Aires and Montevideo.

In this country, having built these three vast craft we just keep them under wraps. Perhaps it is not too much to hope that somebody in authority will get working on the idea that with a nuclear power unit these boats might provide a practical way of getting the air-launched ballistic missile airborne.

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Matters of Moment

An Answer to Lord Brabazon

From Sir Miles Thomas, D.F.C., M.I.Mech.E., M.S.A.E.

MAY I cross swords with my old friend, the Chairman of the Air Registration Board?

It is not often that one is able to add to Lord Brabazon's store of aviation knowledge, but I would like to take him up on a point he made in his brilliant speech at the annual livery dinner of the Guild of Air Pilots and Air Navigators on Feb. 23. (THE AEROPLANE AND ASTRONAUTICS, Mar. 4.)

On the subject of safety in the air, among other things he said: "I think it is odd that in this year we have not got a non-inflammable hydraulic fluid."

The facts of the matter are that a non-inflammable hydraulic fluid, known as Skydrol 500A, is available and is in wide use throughout the World.

Skydrol, made by Monsanto, is mandatory in the Boeing 707, the Douglas DC-8 and the Convair 880, and in their successors, and on this side of the Atlantic it has been made mandatory in the D.H.121 and the Vickers VC10, and is optional in the Vickers Vanguard. In France, all future Caravelles will also be engineered for this non-inflammable fluid.

There is strong circumstantial evidence that the recent incident involving the total loss of a B.E.A. Viscount at London Airport was due to a hydraulic fire, and bearing in mind that the first fire-resistant hydraulic fluid has now been in use for some nine years one can only attribute this type of incident to the reluctance of operators to take advantage of technical progress, rather than the failure of technical progress itself.

Lord Brabazon, hoping that his voice would be heard all round the World, expressed the view that should there be loss of life in an aeroplane accident resulting from the use of petrol rather than paraffin the operator should be "had up for manslaughter." The same might also be said regarding an operator using an inflammable mineral oil when a non-inflammable hydraulic fluid is available.

Anglo-French Aeronautics

DESPITE its somewhat unpropitious number in the series of Louis Blériot Memorial Lectures, this year's event (it was the 13th) was a most amiable occasion. These annual lectures are organized jointly by the Royal Aeronautical Society and its French counterpart l'Association Française des Ingenieurs et Techniciens Aéronautique.

This year it was AFITA's turn to be host and the lecturer—by custom for the French paper, from the U.K.—was Dr. E. S. Moult, C.B.E., Ph.D., B.Sc.(Eng.), F.R.Ae.S., M.I.Mech.E., technical director of the de Havilland Engine Company and president-elect of the R.Ae.S. His subject was "Current Problems in Aero-engine Design." Points from his paper are on page 304.

The occasion was a noteworthy one on a number of counts. It was, for example, graced by the lively presence of Mme. Blériot who made one feel that the event being commemorated by the evening's arrangements could not possibly have been so long ago as a quarter of a century. AFITA's new president, M. Henry Potez—himself one of the pioneers of French aviation—was making his presidential début. And the distinguished lecturer presented a comprehensive survey to make a noteworthy addition to the growing list of notable Blériot lectures.

Among the guests there were several from the U.K. In addition to the R.Ae.S. president, Mr. P. G. Masefield, and the secretary, Dr. A. M. Ballantyne, T.D., the Royal Aero Club was represented by Col. R. L. Preston, C.B.E., and the Society of British Aircraft Constructors by its director, Mr. E. C. Bowyer, C.B.E.

The evening's proceedings opened with the presentation of Dr. Moult's paper, the lecture and the lecturer being introduced by the two presidents, M. Potez and Mr. Masefield. After a few brief introductory remarks by Dr. Moult, his paper was read in French most ably by M. Vialatte of the Ministére de l'Air. A vote of thanks to the lecturer was proposed by M. Desbrueres, president of SNECMA and of the Union Syndicale des Industries Aéronautiques.

As is customary on these occasions, the lecture proper was followed by a cocktail party and by a dinner in the ornate banqueting hall of the Aéro Club de France. Some 125 members of AFITA and their guests were present.

In the after-dinner speeches, M. Potez welcomed the guests and spoke of the close ties between England and France. He had some especially nice things to say about the indefatigable M. Jarry who was recently elected President d'Honneur of AFITA and to whom so much of its success is owed.

Mr. Masefield, in his second speech of the evening in French, gave thanks for the hospitality of our hosts and referred to the "entente cordiale aéronautique" that the occasion represented.

Dr. Moult—also in French—spoke of the long list of distinguished lecturers who had preceded him—including Air Cdre. Banks, who had given the inaugural Blériot Lecture in Paris in 1948. And General Vallin, representing the French Air Minister, spoke of the need for close co-operation among the European countries and of Anglo-French collaboration; he referred in particular to the necessity for close working among NATO nations on the development of ballistic missiles which were complicated and expensive weapons.

The Lunar Explorers

EXPLORATION of the Moon was the theme of an interesting three-part symposium organized by the British Interplanetary Society on March 5 which dealt with the various techniques being developed for discovering the physics and chemistry of the Moon's surface.

Mr. Patrick Moore, the well-known lunar astronomer, began by surveying recent knowledge of the Moon's surface, with particular reference to the celebrated pictures of the hidden side obtained by Lunik III. A particular problem, he said, would be that of maintaining contact between various exploring parties on the Moon in the absence of a lunar ionosphere to reflect radio signals. It was possible that the Earth would be used as a relay station.

On the subject of unmanned exploration, Mr. K. W. Gatland, the B.I.S. vice-chairman, described various methods of landing instrument packages on the Moon, including a large inflatable "cushion" intended to absorb the impact and finally burst under a designed load. The first soft-landing, he thought, would be achieved by launching the probe on a collision course with the Moon and firing a retro-rocket triggered by a radio-altimeter.

Mr. Gatland also showed a model of his MIGRANT soft-landing probe. The subject of a feasibility study begun in 1958, the vehicle exhibits qualities of a VTOL jet-aircraft, making possible a descent from a lunar orbit using a gimbal-mounted H_2O_2/hydrazine rocket motor of controlled thrust. MIGRANT could thus be landed on the hidden side of the Moon while its carrier rocket remained in orbit to receive information from the probe and relay it to Earth. Short periods of hovering flight, permitting a certain amount of sideways drift would be possible to enable the vehicle to obtain a profile "radar" map of the lunar topography and determine level stretches for an automatic landing.

Finally, Mr. W. N. Neat, chief engineer of de Havilland Engine Company's rocket division, discussed the prospects for a manned lunar flight starting from an Earth-orbit utilizing orbital refuelling techniques. He thought, however, that before landing a manned vehicle on the Moon, it would be advisable to send a similar but unmanned vehicle capable of making an automatic descent. This could then be held in reserve by the lunar explorers, and indeed it might be wise to extend the safety provision by building up reserve propellent and stores on the Moon before the actual mission.

NEW C.-IN-C.—In May, Admiral Sir Caspar John, K.C.B., becomes Commander-in-Chief, Home Fleet, and will also hold the NATO post of C.-in-C. Eastern Atlantic. Sir Caspar John has a specialist knowledge of naval aviation. The several important appointments he has held in that field will be well remembered; he was Flag Officer Air (Home) from 1955 to 1957.

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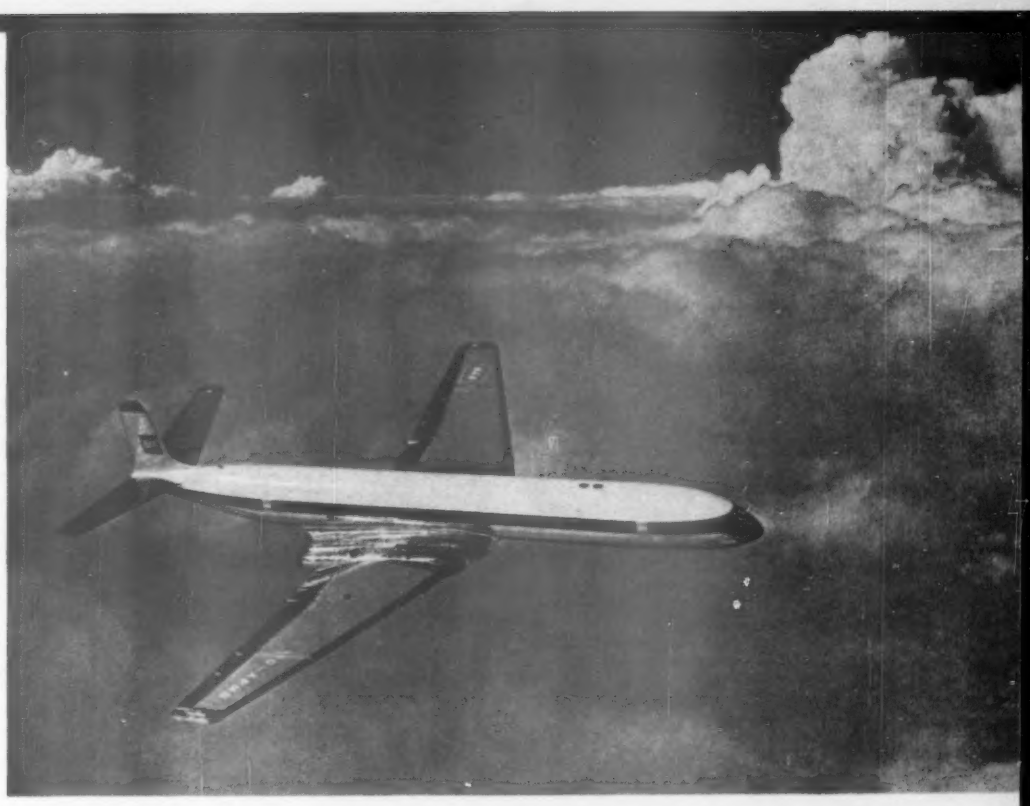


INTO SERVICE.—In April, B.E.A. is to begin operating its new Comet 4Bs with larger fuselages and shortened wings. Here is one of them in the conspicuous new livery of black and white with brilliantly red wings.

Photograph copyright "The Aeroplane and Astronautics"

By Comet to Prague

WHEN the Tu-104 first came to London Airport in 1956 the significance of its arrival was discussed in an editorial in our issue of April 6, 1956. We pointed out that Western European networks, however sound their economics, would have to look out for the competitive effect of Russian jetliners over the parallel routes now being opened up. We warned that it would not be long before the Russians were operating in parallel with the B.E.A. services in and out of Moscow. "What steps," we asked, "are we planning to take if the Russians with jetliners can do the trip between London and Moscow in three-quarters the time taken by our most efficient and revenue-earning Viscounts?"

That was the first time so far as we know that attention had been drawn to the real significance of the arrival of the Tu-104. The fact was that the advent of the Russian twin-jet put B.E.A. into jet transport. In due course B.E.A. ordered a special version of the Comet to its own requirements. The order for six (since increased to seven) of these was placed in the month of August, 1957. B.E.A. is going to start its Comet services on April 1 next.

For these reasons the Editor took special pleasure in the receipt of an invitation to fly on a training flight to Prague last week. It promised to be a useful experience in assessing the characteristics of the Comet 4B as distinct from the earlier variants. It might also provide an opportunity to see something of the city of Prague, though time to do this could not be expected to amount to very much.

As so often happens on such occasions the normal drill is carried out, but the actual departure is much later than planned. As it turned out, the delay on this particular occasion had little or no effect on the outcome.

The weather in this country on the particular morning last week was fine, so that the Comet 4B (Reg. No. G-APMA) was looking extremely striking in the new B.E.A. livery of black, red and white. The colours have been chosen primarily to make machines conspicuous—a necessary consideration in these days of overcrowded ground space and overcrowded air space. Striking colour schemes are also good from a sales angle. It just so happens that the particular colour combination is not what we would have chosen. But the personal disapproval of the Editor of THE AEROPLANE AND ASTRONAUTICS is hardly likely to make B.E.A. change its colour scheme.

However, we do know that we are not alone in deploring the gawkiness of the little red rectangle which contains the white italic capitals "BEA." Never was there such a horrific conflict. The Comet has an elegant raking fin. The uncompromising lines of the rectangle do this no good at all. The italic capitals "BEA" give an excellent idea of movement, of going places, but this idea is brought to a grinding halt by the unyielding slope of the red rectangle. An example of what can be done with italic-type letters and a rectangular containing space is to be seen in the way B.O.A.C. manages the matter. We do hope that somebody in B.E.A. will have another go.

Inside the Comet 4B the colour scheme is again extremely vigorous. The blackly upholstered seats are not quite so jettily black, the red head and arm rests are not so brilliant. The grey-seeming walls and trim are pleasantly restful. Use is made of the extra 7 ft. in fuselage length to have a forward cabin with 22 seats in rows of four, and an extra two. Then comes a mid cabin with three rows of five, and then the after cabin with 49 in nine rows of five and a row of four.

Seeing that no trip in a B.E.A. Comet can last more than 3½ hours, the close packing of the five abreast arrangement is probably all right, but it is no good pretending that the tourist seating of five abreast is making friends for the Comets of B.O.A.C. On long flights, such as those from India, non-technical passengers who do not appreciate the truly remarkable performance figures of the Comet, complain strongly about being cramped. This wants looking into.

Make no mistake. We are going to see a steadily increasing interest in the Comet. Its phenomenal take-off climb and performance make it increasingly appreciated by operators in those parts of the World (and that is most places) where aerodromes are constricted and frequently at altitude.

We flew at 34,000 ft. to Prague and the journey of 90 minutes in the glorious sunlight was over too soon. After circling for a while it had cleared enough for Capt. Angus to bring us in. He would have hesitated, he admitted, to have done so at many aerodromes, for not only were conditions very near the minimum, but the ILS glide path beacon was not working. As it was we circled in to the end of the runway as it came in sight from around 400 ft. But everyone in Prague control tower was so helpful that he had every confidence.

In the drizzle a crowd ran across from the hangars to greet the arrival of the Comet with a cheer. This friendly spirit was evident throughout our stay.

By way of greeting, a Tu-104 and an Il-18 were on the apron. As we have said the first may be regarded as bringing B.E.A. into jet flying; the second, Russia's first turboprop, has anticipated the appearance of B.E.A.'s second generation Vanguard.

It was much to be regretted that the weather worsened so that the 86 guests, including His Excellency the British Ambassador, could not be taken for their promised flight. Their hosts did not feel it would help international relations if an aeroplane full of Czech guests with no passports were put down at Munich, the only practicable alternative airfield available if the weather "clamped." We on the other hand, had already seen enough of Prague to view with delight the idea of spending the night there.

As it was we left in drizzling rain and beneath a low ceiling at teatime. In less than 30 seconds we were rocketing through the murk 1,000 ft. over the aerodrome and all too soon our 100 minutes in blazing sunshine at 34,000 ft. were over. As we landed in London, the lights were twinkling in the dusk.—T.J.

Debating the Air Estimates

THE debate on the Air Estimates did nothing—or very little—to lift the veil on Blue Streak's future, though SIR ARTHUR HARVEY, reading between the lines of the speech of the Minister of Defence and the White Paper, thought the Government did have doubts about Blue Streak now and that there would be a tendency to return to the manned bomber.

Indeed, Mr. Ward, the Air Minister, might himself have been accused of giving this impression, for he never mentioned Blue Streak and he did place great emphasis on the V-bombers. Moreover, this emphasis was strengthened by his remark that we have kept closely in touch with the American design programme for Skybolt in order to ensure that, if need be, it could be carried by the V-bombers.

"Although the increasing sophistication of the defences will doubtless find a way of countering the free-falling bomb and even the stand-off bomb in time, the same does not apply to the bomber aircraft themselves. They have many years of useful life ahead of them yet."

And even after the V-bombers, the emphasis was still on manned aircraft, Mr. Ward suggested that, perhaps when the bombers begin to wear out, their missiles could be taken over by a longer-endurance aircraft capable of combining the rôle of missile-launching with, for example, that of a transport.

That four-minute take-off has been in Members' thoughts ever since the Fylingdales early-warning system was announced. Mr. Ward was quite blunt—the warning was important not so much for the civil population, but to enable the R.A.F. to get the bombers off the ground. Last year the take-off record was six minutes; a month later they set up four minutes, and now, said Mr. Ward, they are working on equipment and installations to get that time down still further.

Regarding Thor Mr. Ward was able to say that the job of deploying it here is now nearly complete with the graduation from training of the last R.A.F. crew to complete their course in the U.S.

He urged the importance of keeping the time-scale right. We must not allow ourselves to get confused between the weapons which we have got today and those which we are going to get in several years' time. And we must keep a proper sense of perspective in looking at the threats which face us.

Again—perhaps significantly—he stressed that the main threat against us is still mainly from manned aircraft, and he quoted the Chief of the U.S.A.F. in support. General White said that the U.S.S.R.'s most dangerous weapon was the Soviet Air Force. "We agree with that assessment," said Mr. Ward. He said firmly that the V-bombers as they are and the Thor missile represent still a valid deterrent.

Mr. Ward also gave some news about the review of manpower and tougher recruiting standards. There are now hopes that the results of the review may be measured in a saving of Service posts "not in hundreds but in thousands." He was able to report that in recruiting for officers, the trend was upwards for almost all branches, including G.D., but they would like to have more recruits at Cranwell and Henlow.

He thought it right to make it more difficult to get into Cranwell—to make it more of a challenge—and after next January they will ask for two A levels in the G.C.E. as the qualification for entry. The course is to be reorganized to put more emphasis on academic subjects in which the cadet shows promise.

In future only basic flying training will be done at Cranwell. Graduates will do their advanced flying training in their fourth year, after they have left the college.

Cadet training at Henlow is also being changed. The course is being increased by 15 months to give a total course of four years and two terms.

MR. GEOFFREY DE FREITAS (Lab., Lincoln), the Opposition's air spokesman, wanted encouragement for M.P.s to visit military installations—he thought it ridiculous that U.S. Congressmen should visit Thor missile sites before M.P.s. He seemed to fear a temptation, once the all-regular Services were established, for a strict application of the regulations preventing contact with M.P.s. That, he thought, would be very undesirable and would produce a community divided into professional soldiers and civilians.

A suggestion that seemed on the surface well worth thought came from WG. CDR. BULLUS (Cons., Wembley N.). He asked Mr. Ward to consider a new type of commission which would suit people who had left school and gone into industry or the City, and then found that the Royal Air Force was more attractive.

Naturally enough, MR. MCMASTER (U.U., Belfast E.) put in a plea for the Britannic. Short and Harland had told him they were going ahead at high speed with its planning and detailed design. This would be the largest and most economic freighter in the World, capable of cutting freight charges in half—sign the contract quickly, he begged.

In reply to this Mr. Taylor, the Under-Secretary, was able to say: "We are pressing both the Minister of Aviation and the firm to get on and get the contract signed—there has been too much delay already."

On transport aircraft, he said 20 Argosys had been ordered and 20 more would be ordered shortly. The first ones are expected in service by 1962.

Fight Against Noise Goes On

AIRPORTS or what goes on inside and above them came in for a good deal of criticism during the debate on Mr. Rupert Speir's Noise Abatement Bill on March 4. MR. A. E. HUNTER (Lab., Feltham), for instance, whose constituency is near London Airport, was very worried at the thought of jet airliners flying in at night. How was anybody going to sleep round there? He wants the Government to increase research into noise abatement from aircraft engines. MR. RONALD BELL (Cons., S. Bucks), who represents many other victims of air noise, commented "without the Boeing the Bill would not be before the House today with any real prospect of success."

MR. READER HARRIS (Cons., Heston and Isleworth) had the last word—the situation, he said, was now such that "if I kick up a fuss about the noise over Heston and Isleworth, the only result is that the nuisance is diverted somewhere else and then perhaps Mr. Hunter has cause to complain."

SIR KEITH JOSEPH, Parliamentary Secretary to the Ministry of Housing and Local Government, replied that careful research is going on about it—and the Noise Committee "will look into it as seriously as it can." Aircraft noise is not covered by the Bill—but Sir Keith's remark about the Committee may be significant.

PARIS TOP TABLE.—At the AFITA dinner following the Blériot Lecture in Paris last week (see pages 300 and 304) were, left to right: Dr. E. S. Moult, the lecturer; Mme. Blériot; Gen. Vallin; M. Henry Potez; Mr. P. G. Masefield; and Miss Jacqueline Cochran, President, F.A.I.

Space and the C.U.A.S.

AT the twenty-eighth annual dinner of the Cambridge University Air Squadron, now 35 years old, speeches from the top table made it clear that, in this era of missile and satellite, the Royal Air Force is still seeking men to fly the aeroplanes, which, more than ever, will be a must whether for carrying strategic or tactical nuclear weapons or carrying troops and equipment to the far places of the earth. Conversation ranged widely but it was indicative of the times that one debate concerned itself with the propriety of painting roundels on missiles which were self-destroying. Was not the roundel the symbol of the Service tradition that the captain must bring his aircraft back? Then there was open envy expressed for the members of the U.S.A.F. who have been selected as candidates to train for space flight.

By tradition, the C.A.S., or his representative, makes the last speech but one. This year Air Marshal Sir Thomas Pike was unable to be present, but sent a telegram of apology in which he clearly stated the intention of the Royal Air Force to maintain its interest in the Squadron. His place was taken by the Vice Chief of the Air Staff, AIR MARSHAL SIR EDMUND HUDLESTON, who emphasized the belief of the Air Council in the usefulness of the C.U.A.S.

Indeed, they would not spend £1,250,000 annually on such establishments if they did not value the contribution that they could make. Such dividends as were forthcoming were more in the form of "intangibles" than in recruits, for only 25 officers from the Squadron had joined the Service since the War.

There was no likelihood of flying disappearing from an officer's curriculum. On present estimates the front line in 1970 looked like being numerically stronger than at the present time. Young men could expect to spend a longer time flying than had his contemporaries of 20 years ago.

He spoke of the replacements coming forward. His reference to that for the V-bomber was guarded, but, of course, there has already been some discussion of the possibility of using a multi-purpose aircraft in the future for launching ballistic missiles. Nobody would expect the point to be discussed on such an occasion but it is interesting to speculate as to which Command would operate Bomber/Transport aircraft.

After this parenthesis, we must return to Sir Edward's closing remarks in which he expressed his conviction that we had got to meet and overcome the absolutely tremendous challenge of space, "We cannot opt out of the space business" he said, to much applause. "If we do not put our backs really into it, we should not only miss the bus but become a third or fourth rate power."

The speeches had been opened by the commanding officer, WG. CDR. J. E. P. THOMPSON, who managed to find a neat way to pull most of the distinguished legs at the top table. He modestly put the remarkable figure of 5,000 accident-free flying hours down to the remarkable weather, particularly that experienced during the Summer Camp at Martlesham. He concluded with a reference to the Canadian off-shoot of the Squadron which was also holding a dinner that night.

He was followed by the Vice-Chancellor of the University, PROFESSOR H. BUTTERFIELD, who explained that two gifts bestowed by fairies at his birth made him most unsuitable for taking any part in aviation. The good fairy ensured that he should never have to worry about the weather, but the bad fairy had ensured bad luck on any mechanical activity, as occurred when it took him 29 hours to get from New York to London by jet.

PLT. OFF. R. W. MACKWORTH-PRAED who wound up the proceedings demonstrated that members of the Squadron have lost none of their gift for making witty, brief speeches, though he must be the first to get away with a public acceptance of a Senior Officer's invitation to meet on the Moon!

An Inconclusive Defence Debate

OF the two-day defence debate which has come and gone, "Parliamentarian" writes that it has left behind it disarrayed dismay among Labour politicians in particular and some unease among Tories.

The former, of course, is Labour party politics, but even among Tories there is undoubted concern at mounting expense combined with the sudden switch to mobility made necessary by the astounding demonstration of Russian rocket accuracy. We have Mr. Watkinson's own confirmation of the Russian ability to put rockets within 1½ miles of the target over a range of 6,500 nautical miles.

Is the "premium," as MR. GEORGE BROWN called it, getting too high? Labour thinks it is, and that led directly to the Shinwell revolt which many Left-wingers found so convenient.

The switch is going to be expensive, of that there is no doubt, and there are so many other things that M.P.s want money spent on.

The debate itself was Mr. Harold Watkinson's major début as Minister. He is a tough, imperturbable character in a job which needs just those qualities. Naturally his speech contained many of those glossings-over which are particularly common to Ministers of Defence, but he did, broadly speaking, acquit himself well.

Mr. Watkinson has inherited a difficult job with the switch. It is fortunate that he has the strength to put through the breakaway from Blue Streak and other fixed-based missiles if this is necessary.

But before we get involved in missiles, M.P.s were interested to hear from him that he hopes it will not be long before he discusses with the aircraft industry a transport jet, perhaps based on the Comet or the VC 10—or perhaps both.

It was high time, he said, that Transport Command and the civil aviation industry worked closely together. Here was an example where they might do just that.

Certainly, the reflection springs to mind that if they have not been doing this before, in the 15 years since the War, it is high time that someone thought of it.

Mr. Watkinson obviously pins hopes on the detailed review of defence which is going on. But he warned that—and one would expect nothing else—this will take some time. The Chiefs of Staff are to play an important part in this.

He maintains firmly that we are still in a position to hit back hard with the Mark Two V-bombers coming into service and equipped with Blue Steel. This, combined with the greatly improved performance of the latest V-bombers makes a force which, he feels will be able to fulfil its planned tasks until beyond the mid-60s. As far as the Navy goes, there are the Scimitars and Sea Vixens, with their nuclear capacity, and there will soon be the NA.39s, while the Army will have two regiments of R.A. Corporals and, soon, Honest John.

Even the four minute warning which the new system is going to give will, he thinks, give enough time to see a substantial part of the V-bomber force in the air.

But what now? The problem, as he said, is not what the Government should do now, but what they do in the closing years of this decade and into the 1970s.

There was still, he said, time to make the choice. His hearers seemed to hope that he and the Government appreciated that while there might be time, there wasn't too much of it.

Blue Streak, said Mr. Watkinson, has taught everyone a great deal, but at the same time his hearers were glad to have his assurance that solid-fuel motors are not being neglected.

But what about mobility? Polaris we know about, but he caught the imagination of M.P.s with Skybolt, launched from the air and invulnerable to the surface-to-air missiles which will put Blue Steel out of the race in a few years' time. He may go to the U.S. to learn more about Skybolt, and on such a visit would also go into the future development of Polaris.

He said right out that we have to rely more and more on mobility and dispersal, and someone else pointed out that the West has more mobility at its disposal than the East. Here, of course, Polaris has its obvious attractions for sea-going peoples with bases all over the World.

In the delivery of nuclear weapons, said Mr. Watkinson, we are, now and for the next few years, as mobile and well equipped as we or our allies would wish and we are capable of a "terrifying retaliation."

Mr. George Brown, the Shadow Defence Minister, thinks that we shall have to decide on Polaris or some other sea-launching site pretty soon. He thinks this is the only one that can arrive in time as the aerial launching site is still a long way ahead.

He defined the fixed-site missile succinctly as "an invitation and not a deterrent."

On finance, Mr. Brown's case is that the premium is getting dangerously high and the cover too low.

There was a suggestion in the debate from Lt. Cdr. Maydon (Cons., Wells) that it might be a good idea to set up a small committee of experts of, say, an industrialist, a senior Service officer and a time and motion study expert, to see if it was possible to cut down the time it took to design a ship, an aircraft or a tank.

Mr. Strachey came down on the side of sea-launching, and visualized the nuclear rocket-firing submarine as the natural successor to Bomber Command. He thought the Navy should be converted to this role.

And for the rest, it was politics—Labour politics. All very distressing for Mr. Gaitskell. Anybody want the job?

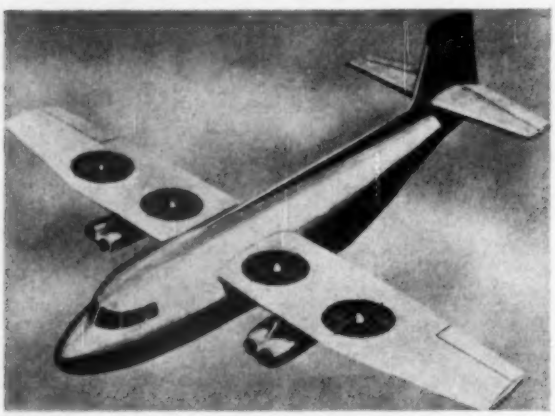
Powerplants in Paris

AS recorded elsewhere in this issue, one of the aeronautical events of last week was the 13th Louis Blériot Memorial Lecture, given in Paris by Dr. E. S. Moult, C.B.E., Ph.D., B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S., technical director of the de Havilland Engine Company and president-elect of the R.Ae.S. He discussed current problems in aero-engine design.

In his paper, Dr. Moult reviewed present trends and the various types of engine required—helicopter powerplants; small, medium and large turboprops; turbofans; direct-lift engines; and supersonic powerplants.

Of this last named he said that the operating conditions of an engine at Mach 3 are severe, with an inlet temperature of 300°C. and correspondingly high temperatures elsewhere. In effect, at these high speeds there is no particular need for a compression process apart from the air intake. In fact the compressor and turbine become rather an obstruction between the intake and the main combustion process in the afterburner. At Mach 3 no less than 75% of the propulsive thrust is provided by the afterburner.

This leads to the transition from turbojet to ramjet. Unfortunately, said Dr. Moult, the ramjet is not self-driving at low airspeeds and the aircraft has to be accelerated by rocket or turbojet or other means. Hence, inevitably, one has a vehicle with mixed powerplants using auxiliary means for

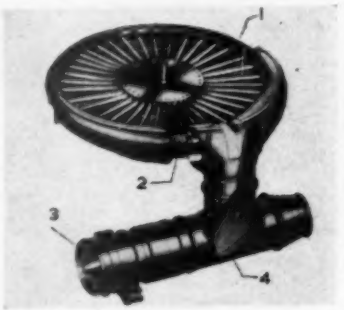


An American VTOL aircraft project using turbojet-driven lifting fans mounted in the wing.

take-off, climb and acceleration and using a ramjet for supersonic cruising.

The combination of a turbine and a ramjet are typified in the Nord Griffon, described in the 1959 Blériot lecture. In a recent paper Dr. R. R. Jamison of Bristol Siddeley put forward a proposal for a supersonic transport combining turbojets with ramjets.

Dr. Moult said that the high temperature problem was far from being the only one. Besides the turbine and combustion system, high temperature operation affects the design of the compressor—demanding titanium or steel in place of aluminium; it affects lubrication of critical surfaces and it poses problems of local boiling or breakdown in the fuel metering system.



A General Electric proposal for a lift-fan powerplant for VTOL craft; (1) is the lift-fan; (2) the power turbine; (3) the turbojet powerplant, and (4) the valve for deflecting exhaust efflux into the fan turbine as required.

The operation of the gas turbine engine is not well understood but a continual process of refinement goes on. The efficiency of components is constantly being improved and this results in better performance. Big gains are becoming increasingly difficult to achieve but there are many possible variations of application which demand attention and which will be exploited in the future.

It can safely be assumed that there will be an even closer co-ordination of the vehicle and its means of propulsion. In addition, great efforts will be made to lighten and cheapen future designs—but not, in aviation, at the expense of overall performance.

Dr. Moult concluded his lecture by indicating six zones of operation of different types of aero-engine. At the low-speed end there will be great interest in lightweight low-cost turbines. In the medium-speed area the economics of operation are very important and we shall see efficient engines of various sizes applied to freighter aircraft and cheap transport.

In the transonic range, plain jets would be converted to the turbofan in the interest of better take-off, reduced consumption and less noise. Above Mach 2, the effects of ram compression become important and there will be an emphasis on intake design and the high temperature operation of jet engines.

Above Mach 2.5, afterburners will be used efficiently for cruising and a variable-geometry exhaust system is important. Above Mach 3 we enter the realm of the ramjet involving assistance for take-off and acceleration.

Good Jobs for Young Men

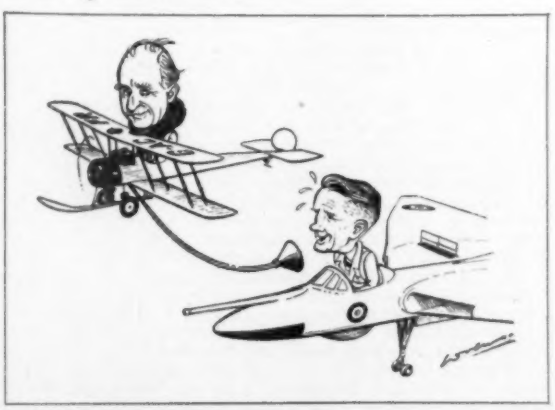
SIR ROY DOBSON, speaking presidentially at the ninth annual dinner of the Avro 504 Club on February 26, told an audience of the old original Avro apprentices and the company's best apprentices of recent years that Hawker Siddeley and their ramifications were now the biggest group of aircraft and associated companies in the Commonwealth, if not in the World. The recent take-overs didn't just happen, he said—they had cost something like £12,000,000.

There was a shortage of top executive material, both here and in America; he would like to retire but, like the man who had a tiger by the tail, he couldn't let go. He assured the young men present that there would always be aeroplanes and good jobs to go with them.

MR. J. A. R. KAY, Avro director and recently "elevated to the Group's peerage," accepted the club's vice-presidency. He represented, he said, the club's "missing generation."

Principal guest was SIR ALAN COBHAM who, with club member FRED HOLMES, reminisced joyfully and acknowledged that the 504K "got us started." ALEC HOPWOOD, best Avro apprentice in 1959, received the club trophy.

Guests included Mr. E. G. Davidson, BP Aviation Manager; Mr. S. G. Joy and Mr. C. E. Fielding; and Jimmy Orrell.—WREN.



"Throttle back" says Jimmy Orrell, "You're gaining on me!"

Air Transport

An Avro Short-haul Jet?

AVRO may build a short-haul turbofan transport as the company's next civil project, to follow the Avro 748. Although no final decision has been reached, a number of design studies has been made and the choice has been narrowed down to two variations of the same theme, the Avro 761 and Avro 771. Market research is continuing, and airline reactions are being obtained, to assess the need for an aircraft of this type and to make a final choice possible.

The Avro project is in the same category as the Hunting H-107 (see THE AEROPLANE AND ASTRONAUTICS for November 6, 1959, p. 435), being a low-wing aeroplane with a wing swept back at about 35°, two rear-mounted turbofan engines and a high-mounted tailplane. One version is suggested with Bristol Siddeley B E.75 engines of about 7,000 lb.s.t. each, to carry 50 passengers; the other is rather larger, with two 10,100-lb.s.t. Rolls-Royce R.B. 163s and 65 passengers. Both are designed for maximum payload operation over sectors of only 500 miles or so—which places the project firmly in the short-haul category. The cruising speed will be about 480 knots and the gross weight about 60,000 lb. for the smaller aircraft, or 70,000 lb. for the larger.

Although designs along these lines have been under study in the Avro project office for more than a year, the idea was given new impetus when de Havilland came into the Hawker Siddeley Group since a good deal of the D.H. work on rear-engine location is applicable to the Avro design. In the category of a Convair/Viscount replacement, this Avro project could complement the D.H. 121 provided that the range is kept down to the sort of value suggested. It is becoming increasingly clear that an aeroplane of this kind will soon begin to interest the airlines, although the larger part of the market will probably not be open for another five years or so.

British Airlines United

A NEW name can be expected to appear among the British independent air transport operators following last week's confirmation that Airwork and Hunting-Clan have agreed, in principle, to merge their air transport interests. The news came as no surprise and was specifically suggested as a probability in our issue for February 5, when we discussed the likely future pattern of the independent industry. Full details of the merger have still to be worked out, and the new name has still to be agreed.

The agreement is between Airwork, Ltd., on the one hand and the Hunting Group and British Commonwealth Shipping Co., Ltd., on the other; the two last-named companies have equal shares (through Hunting-Clan Air Holdings, Ltd.) in Hunting-Clan Air Transport. The new company will be the largest British independent operator, and three shipping companies will have a major interest in it—British and Commonwealth (which is itself the parent company of Clan-Line Steamers and Union Castle), and Furness, Withy and Co. and Blue Star Lines, each of which hold approximately one-third of the Airwork shares. Other shareholders will be Whitehall Securities and Mr. T. L. E. B. Guiness (each with one sixth of the Airwork shares) and Hunting and Son, Ltd.

Wholly-owned subsidiaries of Airwork which will be absorbed into the new company are Air Charter, Transair, Morton Air Services and Olley Air Service. The Air Charter vehicle ferry services from Southend are likely to continue to be operated under the name Channel Air Bridge, and the helicopter activities of Bristow Helicopters, recently acquired by Airwork and now being integrated with Fison-Airwork, will be incorporated as a separate unit in the new company. This company will presumably acquire Airwork's 50% share in Fison-Airwork, or might acquire the latter company outright in exchange for a Fison interest in the airline.

Of the Hunting companies, only Hunting-Clan Air Transport is directly involved in the merger. Field Aircraft Services and Field Aviation Co., Ltd., will not be affected; neither will various other aviation interests of the Hunting Group. Hunting-Clan Air Transport has an interest in Hunting-Clan Air Carriers, Ltd., recently formed in Rhodesia, and the position of this company has still to be clarified.

The joint air transport fleets of the various British companies involved in the merger are as follow: four Britannias; two DC-6As; three DC-4s; eight Viscounts; eight Bristol 170s; 11 DC-3s; five Vikings; two Herons; five Doves; and three Rapides. Some rationalization of this fleet seems likely to follow the merger.

Debating the Licensing Bill

DESPITE one or two sharper sallies the debate in the House of Commons, on March 2 before the second reading of the Civil Aviation (Licensing) Bill, might be described as being almost remarkably affable. Of course—since the purpose of an Opposition is to oppose—there were plenty of criticisms, but an independent listener might not have noticed any very marked differences of views between the two side of the House. In fact, much stronger criticisms can at any time be heard from those whom the new Act is designed to benefit—the independent operators. The climate of parliamentary opinion in air transport has certainly changed since the more doctrinaire days of the early 1950s.

One or two points of possible confusion were cleared up in the opening remarks from the Minister of Aviation, MR. DUNCAN SANDYS, and the closing explanation from the Parliamentary Secretary, MR. GEOFFREY RIPPON. For instance, Mr. Sandys said that companies which are refused air operators' certificates will have the right of appeal to an *independent* arbiter (and, when appropriate, his specialist assessors) and after the Bill becomes law there will be an interval of a few months before these certificates will be mandatory. The transitional route licenses (automatically granted on the basis of existing rights) will remain valid so long as they are not altered or revoked by the Board and are designed to ensure a tide-over continuation of the status quo. Mr. Sandys also suggested that a likely development might be pooling agreements between the Corporations and the independents on certain routes.

Mr. Rippon said that the main aim of the Bill was to bring the law into line with reality and that any "imprecision," complained about by some speakers, in the brief given by the Bill to the Board was designed to allow sufficient flexibility to deal with the continually changing air transport environment.

(*Continued on page 306*)

DELTA QUEEN.—Christened "Delta Queen," the first Convair 880 delivered to an airline flew from San Diego to Miami on February 10 at an average speed of 665 m.p.h., setting a U.S. national record. Delta Air Lines will put the 880 into service in May. Convair now has orders for 49 Model 880s from Delta, T.W.A., Capital, C.A.T. and Avensa, and for 37 Model 600s from American Airlines, Swissair, S.A.S. and Real Aerovias.

Air Transport . . . .

(*Continued from page 305*)

He said that the larger number of Board members (by comparison with that of the A.T.A.C.) was necessary so that it would be able to sit, as and when necessary, in two divisions. Unless they concerned international negotiations, the Minister's "observations" to the Board (which were also subject to criticism) would normally be published.

The opening speaker for the Opposition, MR. G. R. STRAUSS (Vauxhall) had criticized the Bill because it was so vague and imprecise that no one knew what the consequences would be, and because it would inflict serious damage to the two Corporations. The Bill, he said, should have been drafted so that the Corporations were given clear and defined protection against diversion of traffic. By contrast, the first pro-Government speaker, MR. W. SHEPHERD (Cons., Cheadle) insisted that competition could have a beneficial and stimulating effect and that the applicants should not have to establish the need for a service, but only to establish that this need was capable of being generated.

Another speaker, MR. PAUL WILLIAMS (Cons., Sunderland South), suggested that at some suitable later stage the Board should be given an overriding instruction that its main aim must be to promote an increase in British air transport. GP. CAPT. C. A. B. WILCOCK (Lab., Derby North) pointed out that, even if the Board's decisions were, on occasion, to be detrimental to the Corporations' interests, they would not necessarily be detrimental to the overall British air transport effort—which was the thing that mattered.

Hardest hitting of the anti-Bill speakers was MR. JOHN RANKIN (Lab./Co., Glasgow, Govan). He said that there was nothing in the Bill to explain that the Board had any particular purpose, or that it should collect statistics of finance, traffic, profits and losses so that it would know exactly how the private airlines were getting on by comparison with the Corporations. He suggested that the object of the Bill was simply to create one, or perhaps two, great independent mergers to compete with the Corporations. Another member, MR. G. R. CHETWYND (Lab., Stockton-on-Tees), also suggested that the Board should be able to call for full financial and traffic statistics so that the relative merits of the applications could be properly assessed.

Speakers on both sides of the House were in unquestioning favour of the sections of the Bill which will make for complete control of the operating safety of all air transport undertakings by the issue of Air Operators Licences.

Transcontinental Competition

INTERCONTINENTAL Boeing 707-320s have been introduced by T.W.A. on U.S. transcontinental services to obtain a speed advantage over American and United, its two competitors on the non-stop continental crossing. This step seems to have sparked off a new round in the "which-is-fastest" controversy between the Boeing 707 (American and T.W.A.) and DC-8 (United). Until the begining of this month, all three airlines used JT3C-powered domestic models and by agreement published identical journey times in their timetables. With the JT4A-powered 707-331, T.W.A. claims a 15-20 minute schedule reduction, although this is obtained at the expense of flying above the minimum-cost speed of Mach 0.82. The T.W.A. maximum-speed cruise (MSC) operation is conducted at Mach 0.84 (see our issue for Dec. 11, 1959) with increased fuel consumption.

The T.W.A. decision is interesting because it indicates that the jet capacity of the three airlines on the main transcontinental trunk routes now exceeds the traffic offering by a large enough margin to make competitive selling a necessity. United Air Lines will be in a position to hit back with the JT4A-engined DC-8 quite soon, and has already announced its intention of using this variant on the trunk routes as soon as possible. American Airlines will then, apparently, be in a poor position to meet this competition since its 707-120s would have insufficient range for a non-stop crossing at speed much above Mach 0.82, even if the operator was prepared, like T.W.A., to accept the economic penalty of the higher speed.

Regularity data compiled by the C.A.B. (according to *Aviation Week*) show that none of the three trunk operators has been doing very well in this respect—a fact which has led to the scheduled journey times being increased, as we reported on February 5 (p. 155). In the month of November less than 28% of United's flights westbound to Los Angeles and San Francisco arrived within 15 minutes of schedule; about 49% of American's and 58% of T.W.A.'s services were less than 15 minutes late on arrival at Los Angeles. Eastbound, about 13% of United flights were within 15 minutes of schedule at Idlewild; American recorded 24% and T.W.A. 40% less than 15 minutes late.

B.E.A. Bus Service?

THE possibility of a "bus service" operation by B.E.A. over selected routes next spring was mentioned by Mr. Anthony Milward last week. He apparently had in mind a "no reservation" service, for which passengers would purchase tickets (presumably at a sub-standard rate) upon arrival at the airport of departure.

It goes without saying that the success of such an idea depends on seats always being available on demand. Intending travellers must be reasonably sure of getting a seat within an hour or so of arriving at the airport, and a high frequency of service is therefore necessary. The scheme can be applied more easily to domestic than to international flights, and B.E.A. plans at the moment are directed towards the London-Glasgow route, although the London-Paris service has also been mentioned as a possibility "later on."

The Vickers Vanguard, coming into service with B.E.A. on July 1, seems to be ideally suited to this kind of operation, with its massive capacity (139 passengers), its ability to carry large quantities of fill-up freight and its low operating costs.

"No reservation" services are already being operated in the U.S. by Allegheny Airlines on their Eland-Convair and by Continental Airlines on some Boeing 707 flights. In both these cases, passengers purchase tickets on board the aircraft; those who wish to make sure of a seat can book in advance and pay more for the facility.

A Plea for Airport Planning

IN a memorandum sent to the Minister of Aviation, the Association of British Chambers of Commerce has recommended the opening of additional strategically situated airports to form a national network to serve liberalized and growing air traffic needs. Municipalities should, the memorandum says, be encouraged to own and to operate airports by means of Government grants on a diminishing scale for a limited period of 10 years.

The memorandum also recommends that Customs facilities should be provided at a selected chain of airports for which a unified air traffic control system and certain technical services should be provided by the Government. Aircraft fuel should be free from duty on domestic services as well as on international services.

The Association points out that the Ministry's wish for municipalities to accept responsibility for airports must, for success, be accompanied by a practical policy of financial inducement. Few municipalities will be persuaded to take over without such an inducement and, since airports are national as well as local assets, it would be equitable if part of the cost of running them were to be borne by the Exchequer. If airports are to be profitable it is essential that they are adequately equipped from the start—hence the need for financial and other assistance.

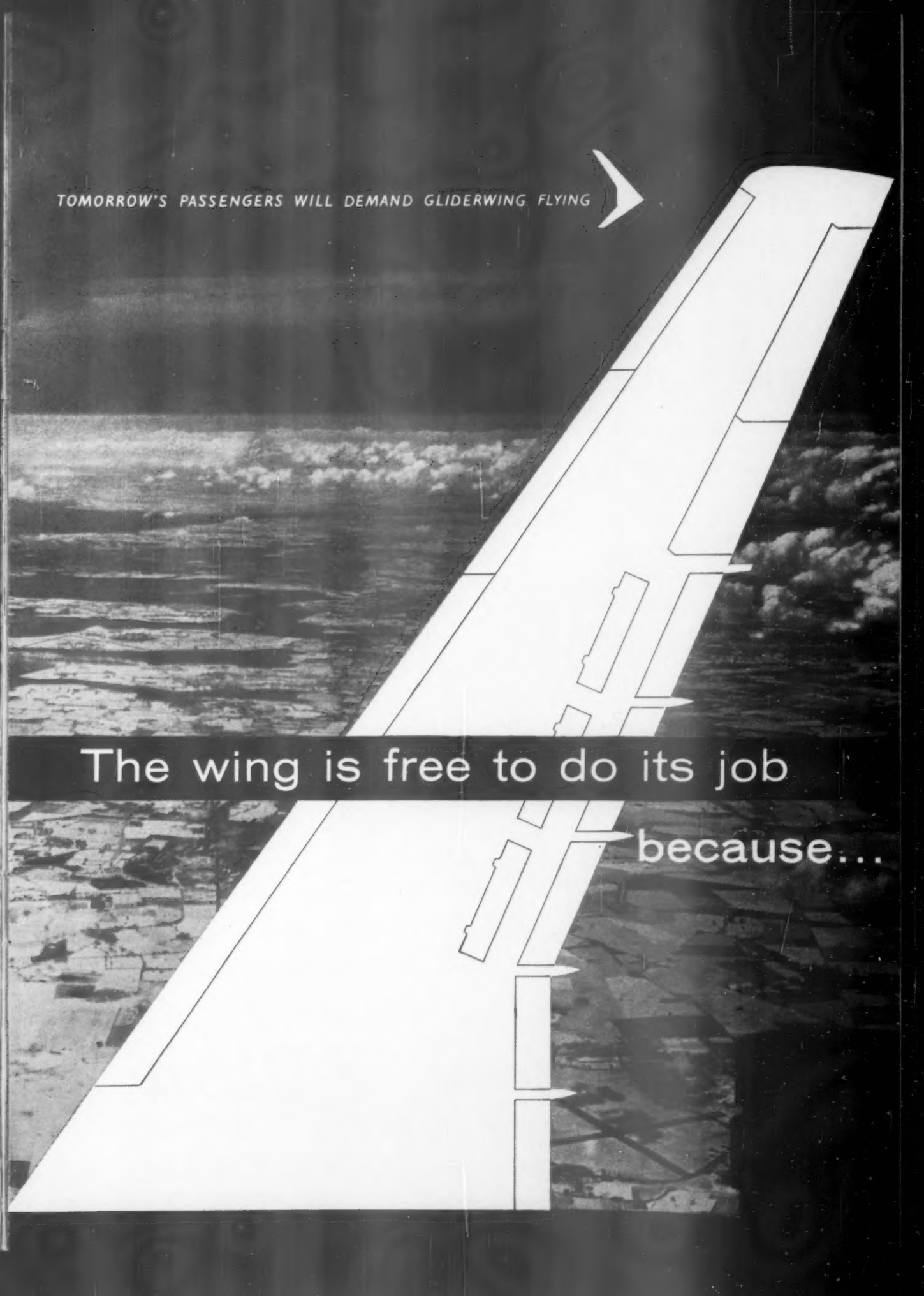
Improving the Argosy

AS we briefly recorded last week, the maximum weight of the A.W.650 Argosy has been increased from 82,000 lb. to 88,000 lb. This has been accompanied by a small increase in maximum payload, from 27,000 lb. to 28,000 lb., but the more significant result is that the full payload can now be carried about twice as far as the earlier performance estimates showed. The freighter certificated to British requirements has a max. landing weight of 80,000 lb. and can carry a payload of just under 27,000 lb. over a 520-naut. mile sector with typical reserves. To American requirements, the max. landing weight is 78,000 lb., allowing a 24,400 lb. payload to be carried for 650 naut. miles.

The entire payload-range curve has been shifted to the right as a result of the weight increase. Thus, the range with 20,000 lb. of payload is now 1,090 naut. miles, and with 15,000 lb. payload, 1,480 naut. miles, with reserves. The maximum range on standard fuel capacity, with payload reduced to zero, is 1,950 naut. miles.

Flight trials have showed that cruising speeds up to 258 knots can be achieved, at 20,000 ft. and 50,000 lb., with the engines at 14,200 r.p.m. The makers now quote a mean cruising speed of 243 knots at 65,000 lb. at 22,000 ft. The new weight has increased the take-off field length required from 4,080 ft. to 4,650 ft. in I.S.A. at sea-level. At 4,000 ft. and I.S.A.+15°C., the length required is 5,900 ft.

Direct operating costs, worked to the A.T.A. formula and assuming 3,000 hr. annual utilization and U.S. domestic fuel costs, are at their minimum of 9 cents per short ton-mile at a sector distance of 600 naut. miles. The passenger version with 77 coach class seats (16,095 lb. payload) has minimum costs of 1.35d. per passenger-mile over 870 naut. miles.


TOMORROW'S PASSENGERS WILL DEMAND GLIDERWING FLYING
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the engines are in the right place

The airline silhouette of the future, with its clean wing and rear mounted engines, offers many important advantages:

- The clean wing has higher lift and lower drag, giving superior airfield performance and better high Mach number characteristics
- Full span leading edge lift devices and uninterrupted flaps
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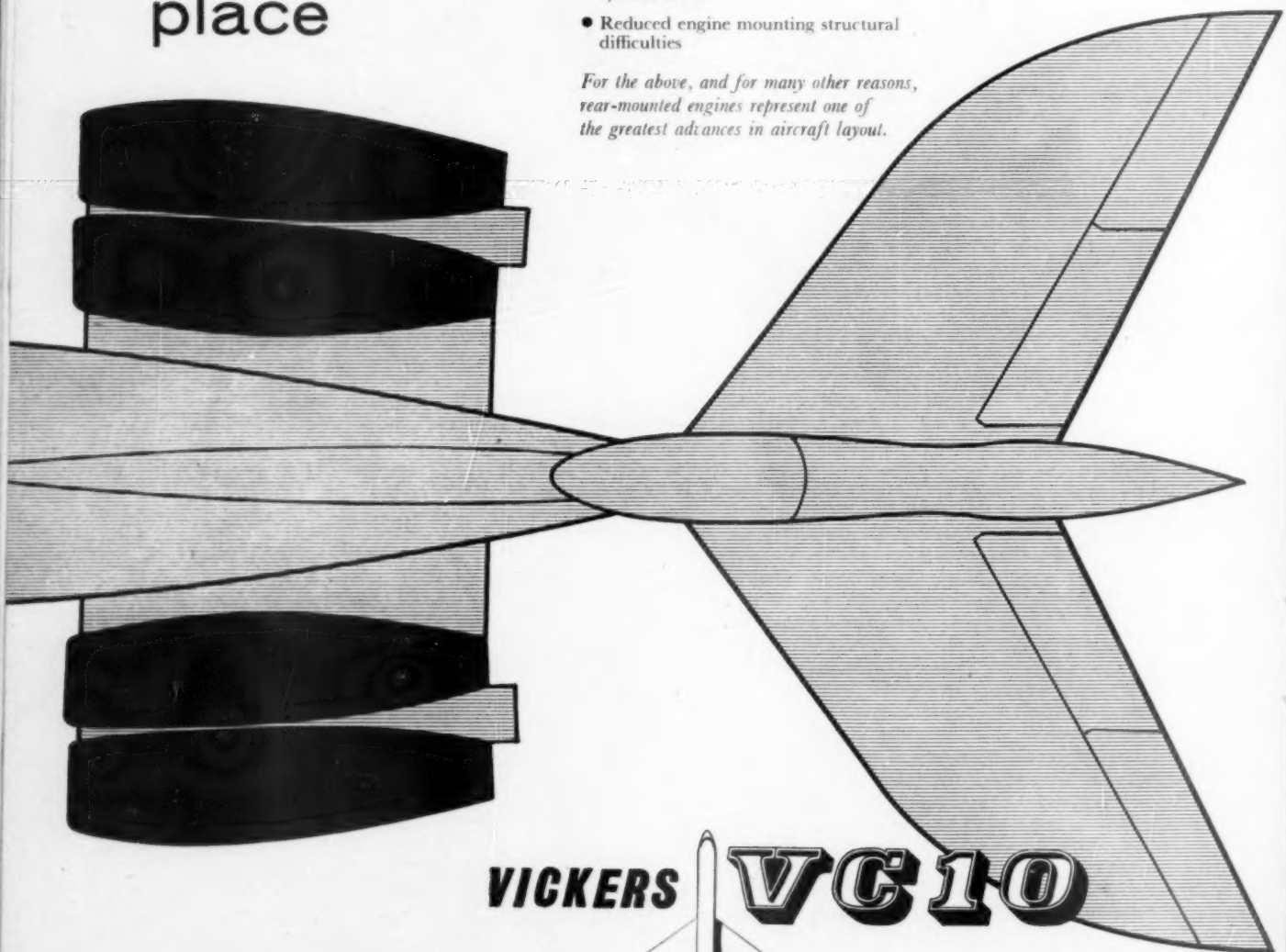
- High-set engines with minimum debris risk
- Simpler maintenance from better systems access
- Reduced engine mounting structural difficulties

For the above, and for many other reasons, rear-mounted engines represent one of the greatest advances in aircraft layout.



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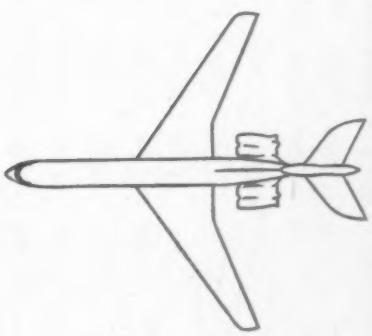

The Conway R.Co.42 of 20,250 lb. thrust is the most powerful and economical jet yet scheduled for production.

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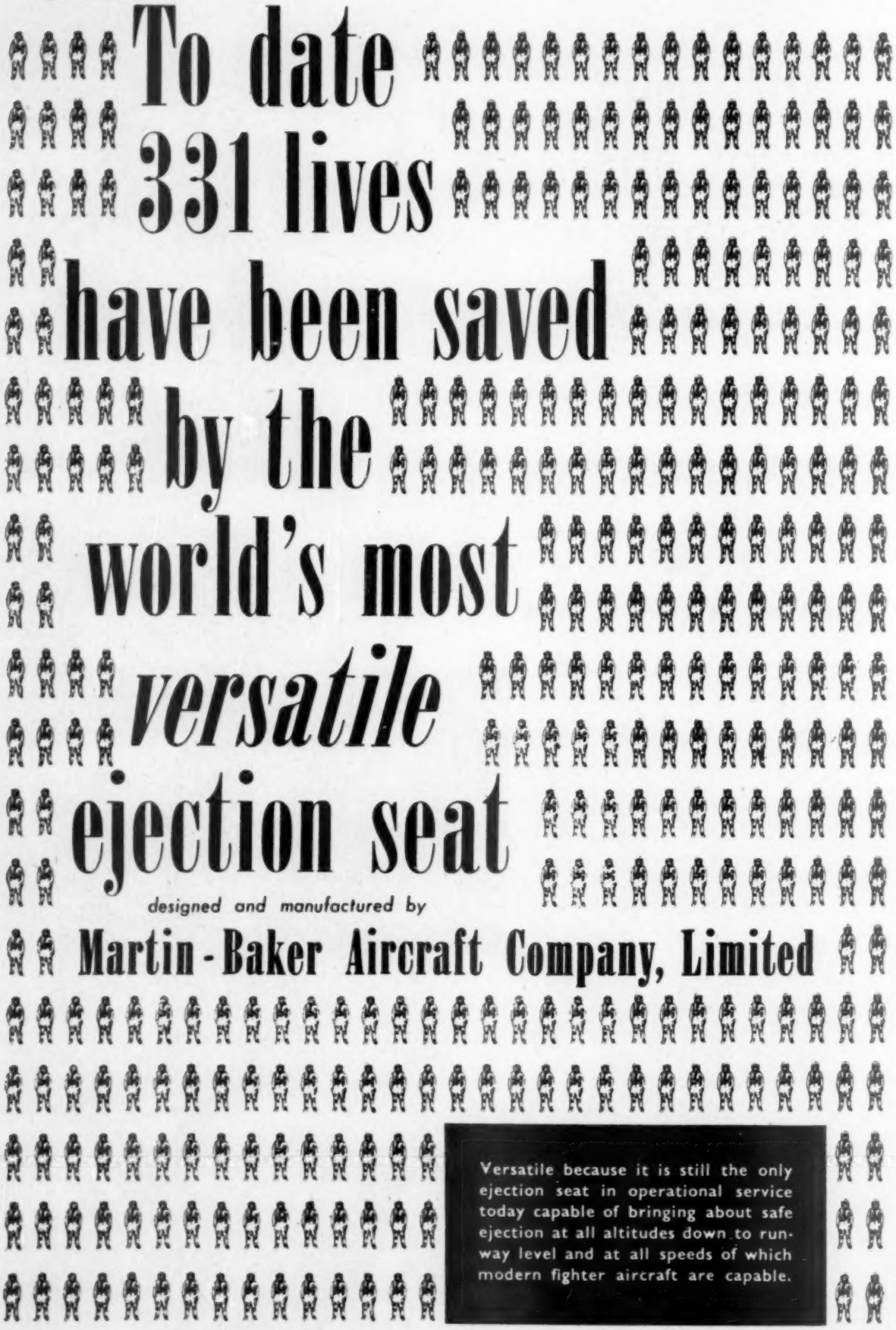
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331 lives
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Versatile because it is still the only ejection seat in operational service today capable of bringing about safe ejection at all altitudes down to runway level and at all speeds of which modern fighter aircraft are capable.

Air Transport . . . .

Developing Scottish A.T.C.

THE new combined Scottish Air Traffic Control Centre and Scottish Air Communications Centre, which is to be built at Gailes, Ayrshire (as we reported in our issue for February 19), is part of the £5 million development scheme for the whole of the U.K. A.T.C. system. It will replace the present Scottish Air Traffic Control Centre at Redbrae, close to Prestwick Airport—where, as we also reported, a Ferranti computer for automatic data processing is to be installed in the spring of 1961.

Also to be included in the new centre at Gailes is the North Atlantic HF/RT Communications, now at Birdlip, Glos., which also covers the Europe/Mediterranean region. The site comprises some 180 acres on the main road between Prestwick and Irvine, and the new buildings are to be ready for use by March, 1963. Area-coverage radar is already located on the site and has been taken over from the Air Ministry. It will shortly be brought into use by the M.o.A. to assist air traffic control in Scotland. Also to come into use shortly is the radar installation at Renfrew, and similar equipment will be installed in the new tower to be opened at Prestwick next year.

Some Vanguard Impressions

A proving flight—with its inevitably crowded flight deck and the continual passing to and fro in the passenger cabins of a score or more of technicians—does not usually offer the best of opportunities for assessing an aircraft from the point of view of a future passenger. Nevertheless, it may be useful to expand on some of the notes offered in last week's issue (p. 273) following a week-end trip in the Vickers Vanguard on the Paris run during two of its 30-day series of intensive European operations.

The most noticeable passenger-feature of the Vanguard is its roominess—and this also applies with particular value to the flight deck. Six-abreast seating for economy and tourist-class passengers becomes a reasonable proposition, with an ample aisle-width, when the inner diameter of the fuselage is of the order of 130 inches, and five-abreast seating can be comparative luxury even for first-class passengers. As with all propeller-driven aircraft the first-class compartment is at the rear of the fuselage, but there is not very much difference between the various compartments in the fuselage so far as noise and vibration levels are concerned, and these levels vary in different parts according to the régime of the flight.

Since the noticeable noises are those concerned with the air-conditioning system and the external airflow, speed can be important. On the outward journey to Paris there was some doubt on the flight deck about whether or not all the undercarriage legs were properly locked home and the indicated airspeed was therefore held down to 190 knots—providing the most restful of journeys for the passengers at the cost of about 13 valuable (?) minutes in the stage time. This time, take-off to touch-down, was, in fact, 56 minutes, whereas out and home runs on the following day were each completed in 43 minutes—giving a block speed of 300 m.p.h. for the point-to-point distance between L.A.P. and Le Bourget, and one which would be higher if the actual airway distance were to be used.

The wide and roomy flight deck of the B.E.A. Vanguards is laid out for practical two-crew operation and the aircraft can be completely handled from either seat. There is a fully adjustable "permanent" seat for a third pilot, or check captain, behind the centre console. This carries, in addition to the usual power, trimming, automatic pilot and other items, the radio controls, so the pilots do not have to risk vertigo when, for instance, tuning the ADF. The roof panel is reserved for controls, such as those for the pressurization, which do not demand immediate or continuous attention. The pilots' flight panels have the four essential flight instruments—the artificial horizon and gyro compass (or, in the B.E.A. case, the director horizon and beam compass of the Smiths Flight System), the A.S.I. and altimeter—marked out as a "basic T."

But, apart from the excellent all-round view and depth of screening, the really practical feature of the Vanguard's flight deck results from the thought which has been given in its design to the space requirements of a workaday and even domestic nature. There is a vast area between the coaming and the base of the main screens—but this should never need to be used for the temporary disposal of the gloves, flashlamps and so on which usually grace this part of an aircraft's flight deck. For once, the flight-deck crews have room to move and proper places for putting things like uniform hats and coffee cups.—H.A.T.

Paying for Airspace

CANADA is proposing to charge a $64 (£23) fee for the use of navigational aids at Gander by aircraft which do not land at the airport, according to U.S. officials. Such a charge, intended to supplement the income from airport landing fees and to help to pay for Government-maintained airways facilities, is unprecedented—but is likely to become more common.

In our February 26 issue the Ministry of Aviation's predecessors were reported as recognizing "the need to introduce *en route* charges in the future." At present, aircraft of only one airline overfly the U.K. without using any U.K. airports, and landing charges can therefore be used to recover as much as possible of the cost of the facilities from all operators but one. The Treasury is known, nevertheless, to be worried about the aircraft (about 10% of the whole) which overfly the U.K. without stopping, and those which land at municipal and private aerodromes.

PROVING FLIGHT.—Impressions on the flight deck and in the main passenger compartment of the Vanguard (seen below at Le Bourget, Paris) during its proving flights. Note the comparative roominess of the six-abreast seating layout and the built-in air-stairs for both forward and aft doors

Air Transport . . . .

Building up an Air Freight Business

MOST people know that British European Airways' freight traffic has been increasing during the past four or five years at a fairly spectacular rate. The average annual tonnage increase has been more than 20%; the figure for the calendar year 1959 (at 33,852 short tons) was 26.6% higher than that for 1958; and revenue from freight traffic has doubled since 1955.

There has been nothing of a so-called "break-through" about this progress. It has been the result of hard selling (to the right people at the right times), of good overall organization and of growing experience. The business was there all the time and steady effort of this kind—made, so to speak, from the ground up—has laid a sound foundation for even more rapid future progress. This year the arrival of the Vanguard, with its very ample fill-up cargo capacity, will give B.E.A.'s freight division the chance really to begin to stretch itself and to profit from the development of the past few years.

For those who are inclined to believe that the appearance of the specialized all-freight aircraft must precede any air-cargo millennium there may be a lesson in the fact that, so far, only about 35% of B.E.A.'s freight is being carried in cargo aircraft. The bulk of the traffic goes as fill-up payload on normal passenger services. Obviously there is already a place for the specialized freighter—and there will be an increasingly more important place for it in the future—but until the traffic has built up and the flow is regular through 24 hours, seven days a week, economic utilization cannot be maintained except on a few heavy-traffic services. The question is simply whether the chicken comes before the egg—and meanwhile the fill-up system provides essential service frequency. Possibly the appearance of the Vanguard, with its big-capacity holds, will eventually encourage the appearance of so much cargo of the bulkier kind that the balance will slowly be altered.

On the freight-sales promotion side the emphasis is laid on the demonstration of cases based on the total cost of distribution for chosen industries and commodities. So far as is possible, air transport is sold only for commodities and loads which are known to be a really practical proposition. Apart from direct mailing, the sales team applies effective, factual advertising techniques in associated trade journals, giving examples of air freight advantages (the figures are provided by customers) and representative lists of special commodity rates. Typical among the examples used is the breakdown reproduced below, for which the costs were those provided by the shipper—an electronic equipment manufacturer. They compare the total cost of the transport of a computer from the London area to Dublin.

	Surface Transport	*Air Transport*
Packing	£388 0s. 0d.	£227 12s. 0d.
Carriage to docks or airport	£30 0s. 0d.	£21 0s. 0d.
Freight charge	£40 0s. 0d.	£179 16s. 9d.
Insurance	£38 15s. 0d.	£24 12s. 6d.
Total ..	£496 15s. 0d.	£453 1s. 3d.

This breakdown has a special interest because it shows how the *total* distribution costs may be in favour of air transport, quite apart from any advantages in speed or convenience. The relatively high air-freighting charge is more than offset by the considerable savings in packing and insurance costs.

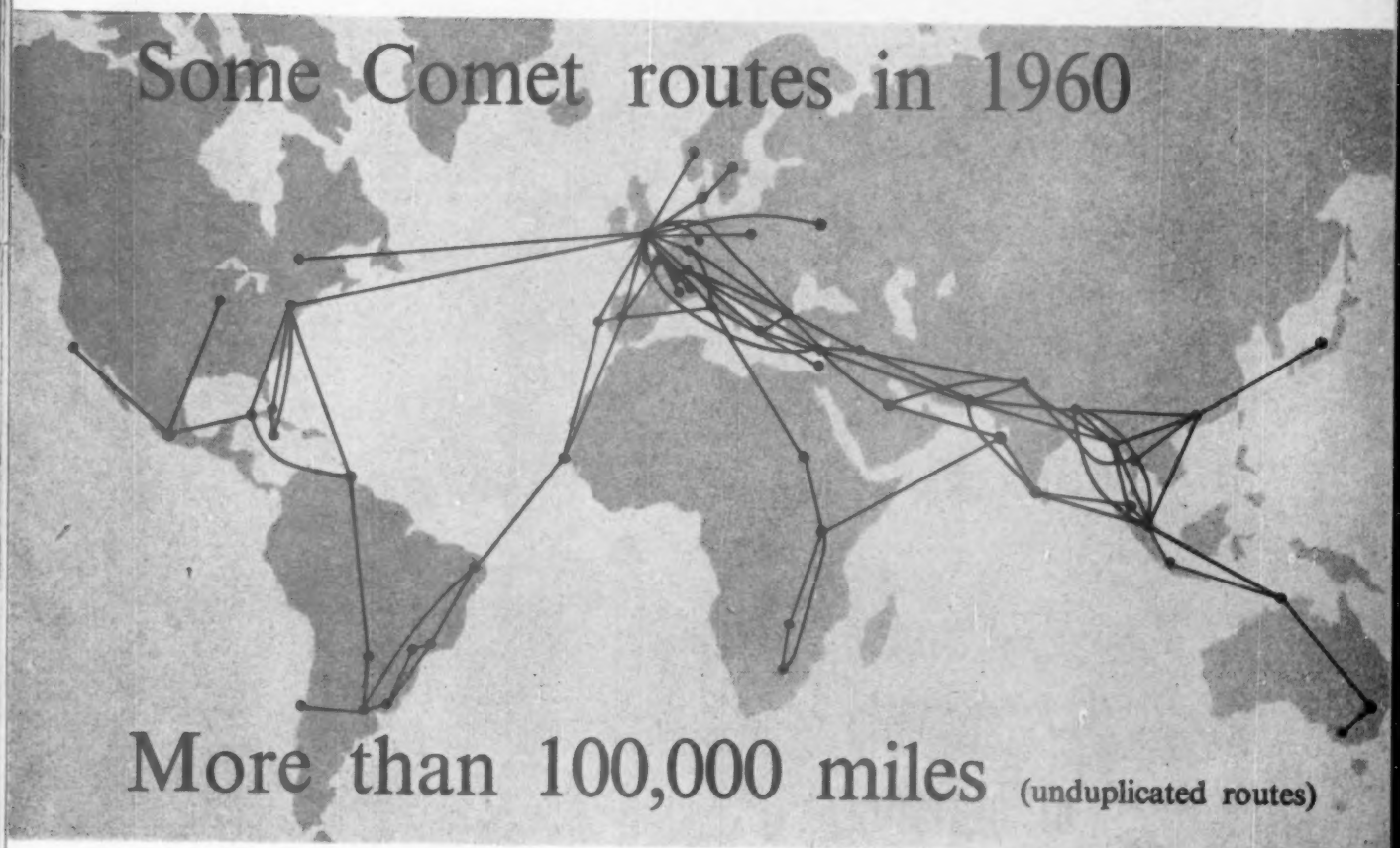
There is an interesting side issue in this matter of packing. Experience has shown that delicate machinery is less likely to be damaged in transit when it is lightly packed (or simply protected by transparent covering) than when it is heavily and carefully boarded up and protected. The reason is simple: when lightly packed the nature of the cargo can be seen and it is handled accordingly.

Queer discoveries are sometimes made by air-freight sales people. They might find, for instance, that the advantages of a steady flow and small stock for the consignee cannot be enjoyed with certain commodities because their manufacture is planned in large batches and the shipper is himself short of warehouse space. Sometimes, too, both shipper and consignee prefer delivery to be slow because both are saving warehouse charges while the goods are in transit.

Another peculiarity of the freight business is that shippers and manufacturers think in terms of working days and

(*Continued on page 309*)

"Experience has shown that delicate machinery is less likely to be damaged in transit when it is lightly packed (or simply protected by transparent covering)" and "some surprisingly heavy and oddly shaped items are accepted unquestioningly . . ." One of two 1½-ton chewing-gum packaging machines is seen here being loaded on to a Paris-bound Viscount.



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The Wessex can carry a military load of 998 kg. over a range of 340 n. miles (630 km.) at a cruising speed of 100 knots (185 km./hr.). This most versatile of modern helicopters can be used in many other roles including ambulance, trooping (16 fully-equipped men), freighting, passenger transport (12 seats), crew training and carrier plane-guard. Salient features of the Wessex include:—

- Quietness of operation.
- Considerably reduced maintenance and servicing commitment since the conventional cooling fan and clutch unit are no longer required.
- Rotors and Transmission parts are all backed by thousands of hours of in-flight proving.
- Complete Automatic Stabilization Equipment can be provided.
- In large scale production for the Royal Navy.
- Rapid conversion possible from one role to another.
- Can lift and fly with external loads of up to 4,000 lbs.

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(*Continued from page 308*)

working weeks—so that shipments are completed at the end of each day, or the end of each week, and there are peaks of night and week-end traffic. Before air freight can come fully into its own this way of thinking must be altered so that there is a more regular flow. Meanwhile, the fact that the peaks are so placed means that the cost is increased because of the overtime and shift work which have to be maintained.

But this "dead time" habit can have effective results when it is combined with local time variations. When the Comet goes into service on the Moscow run it will leave London at midnight, arrive in Moscow at 5.30 a.m. (local), depart again at 8 a.m. and arrive in London at 9 a.m.—all of them convenient times for shippers and consignees.

Much of the increased freight business enjoyed by B.E.A. is the result of a very carefully planned series of European commodity rates designed (with the agreement of all the airlines concerned) to increase the loads on poor traffic routes. It is not generally known that (except for the North Atlantic commodity rates introduced this year) only the basic minimum freight rates are fixed by IATA at the annual traffic conferences and that the commodity rate pattern in Europe is remarkably flexible.

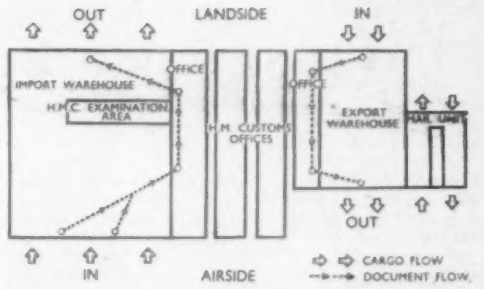
Temporary special or development rates can come into force in less than 10 days if the airlines concerned agree and after the figure has been approved by the IATA secretariat. Permanent or semi-permanent rates are agreed by commodity rate boards which are convened four times a year. Applications are rarely resisted by other airlines—which usually maintain the philosophical view that what is good for one airline is likely, in the end, to be good for all. Even when aircraft are offered for charter on certain empty sectors, sensible rates usually win in the end. There may be a period during which free-for-all bidding produces temporarily uneconomic rates, but they generally settle upwards to a sensible figure.

B.E.A. normally uses British Road Services or British Railways' passenger services for surface-transport sectors and all freight outside the London area is delivered direct to the appropriate airport—usually L.A.P. Only London-area shipments (and by no means all of these) are collected at B.E.A.'s Dilke Street, Chelsea, cargo depôt, which is also used by B.O.A.C. In the London area, collection is contracted to private carriers whose vans wear the Corporation's insignia. Reservations by telephone to Dilke St. can be made during the open period (08.00-21.15 hrs.), or to the L.A.P. cargo unit at any time, day or night, for all flights, whether leaving in a few hours or a few days.

The cargo unit at London Airport Central is a story in itself. Though "temporary" to the extent that the unit may eventually move into an M.o.A. cargo centre in the "diamond" area (though no firm plans have yet been made for such a consolidation), there is nothing temporary about the organization.

There are, in effect, two cargo units, one for export and one for import, and, because of the complete difference in their operating conditions, they are physically separated by a large section of the building group in which the Customs authorities have their offices. The whole depôt covers 50,000 sq. ft. and, throughout, mechanization is used to a maximum extent. The latest plans include conveyor belting and pneumatic tubes.

In simplest terms it might be said that the export section can be, and has been, organized simply for the expeditious and economical handling of cargo shipment, whereas the import side is necessarily organized, in the main, to suit the overriding and complicated requirements of H.M. Customs and Excise Department. Apart from spot checks, Customs are not much concerned with outgoing freight, whereas they are intimately interested in all incoming freight. As an instance of the effect of this interest a document-handling and filing system has been



This sketch plan shows the general layout and the cargo and document flows through the B.E.A. Cargo Unit at L.A.P.

evolved by the unit to permit the immediate inspection of all the paper work concerned with every single import shipment made during the previous three or more years.

On the export side the warehouse racking and documentation offices are each divided into sections covering five European areas. After reception and weighing the packages are sorted and racked accordingly. When the paper work is completed the appropriate documents rejoin the goods at the "air side" end of the unit where the cargo is grouped in floor-areas marked according to the flights for which they are destined. There is a strongroom for special cargo and a heated room for livestock. On the import side these are supplemented by a tiled coolroom for foodstuffs and other perishables.

Heavy, bulky, or odd-shaped items are assessed in relation to known freight-hold dimensions and to the dimensions of other cargo being carried, and, if any doubt exists in the minds of the supervisors, a trial loading may be arranged well in advance of the flight. Throughout the organization the rule is "when in doubt leave out," so it is rarely that loading is found to be impossible at this stage—and some surprisingly heavy and oddly shaped items are accepted unquestioningly and quite correctly by the specialists, whereas a non-specialist onlooker might be in grave doubt about their suitability as fill-up cargo. The organization is such that goods can normally be accepted up to four hours before a flight and the last item must leave the dispatch office not less than one hour before the time of aircraft departure. Special arrangements may be made, at the time of booking, to accept goods nearer to the time of departure.

An average of about 420 tons a week, in some 9,500 consignments, pass through the export section and, apart from outgoing newspaper traffic, imports are now at a similar level. The overall ratio in 1958-59 (including newspaper traffic) was 58% exports and 42% imports.

Transport to and from aircraft on the apron is the responsibility of the M.o.A. staff and is completed in Ministry-operated vans known locally as "yellow perils." Those carrying the incoming freight are locked and guarded by Customs until the load is safely in the bonded warehouse in the import section of the unit. There is a concession for transhipment goods which are for onward transport by B.E.A. or associated operators using L.A.P. Central; these are sealed and passed straight over to the export section for onward flights. Items for onward transport by "long-haul" (L.A.P. North) operators are locked in a transhipment cage until they are either taken across to the North Side, under suitable Customs security, in the hourly B.E.A. van, or collected, if time can be saved thereby, in the bonded vehicle of the airline which is carrying the freight on the continuation of its journey.—H.L.A.T.

B.E.A. Results

TRAFFIC statistics for B.E.A. operations in December and January show that the Corporation is continuing to grow at an above-average rate. Compared with the same months a year before, the December ton-miles increased by 17% and in January the increase was 20.3%. The average rate of growth of passenger traffic throughout the World in 1959, according to ICAO statistics, was 12%, compared with which B.E.A. recorded an 18% increase in the calendar year. It is interesting to record that B.E.A. now carries about one in 10 of all passengers making an international journey by air. (ICAO figures for 1959 record 20 million international passengers in a total of 96 million.)

The table (right) shows the December and January results, and the big increase in freight will again be noticed. Although the percentage increase here is influenced by the depressed figures of a year ago, when many services were interrupted by fog, the actual tonnage of freight now carried in a month is as much as the total for the first full year of B.E.A. operations.

In 1947-48 the total was 2,610 short tons, whereas that for the calendar year 1959 was, as recorded in the article above, 33,852 tons—or an average of 2,821 tons per month throughout the year.

TRAFFIC RESULTS—DEC. 1959 AND JAN. 1960

	December 1959	Variation from Dec. 1958	January 1960	Variation from Jan. 1959
Capacity ton miles offered	12,774,400	+11.4%	12,642,100	+ 9.4%
Load ton miles sold ..	7,948,700	+17.0%	7,878,700	+20.3%
Revenue load factor ..	62.2%	+ 5.1%	62.3%	+ 9.9%
Passengers carried ..	182,185	+19.2%	179,361	+20.7%
Passenger miles flown ..	63,313,100	+13.8%	65,255,000	+16.1%
Passenger load factor ..	61.2%	+ 5.9%	62.5%	+ 8.9%
Freight ton miles	1,245,000	+30.5%	1,162,900	+39.3%
Mail ton miles	509,300	— 4.0%	314,000	— 2.9%
Aircraft miles flown ..	2,431,500	+ 9.7%	2,395,400	+ 8.5%
Revenue hours flown ..	12,645	+ 6.1%	12,298	+ 6.9%

Flying the V-STOL Courier

by John Fricker

IN discussing, during recent weeks, a variety of STOL aeroplanes which I had encountered, the still-air performance requirement of take-off and landing over 50 ft. within a distance of 500 ft. was mentioned as a NASA definition for these types. The point was made that virtually only a handful of experimental fixed-wing aircraft is at present capable of meeting such a demanding criterion, and it was suggested that they should be more appropriately designated V-STOL types.

In the American Helio Courier, however, there does exist one production aircraft which is fully able to conform to this very short take-off and landing distance. Its near-helicopter capability appears to be virtually unique, at the moment, and it is certainly the most advanced high-lift aeroplane in wide-scale commercial service. Well over 100 have so far been sold, and are operating in many countries throughout the World on jobs which hitherto would have necessitated the use of helicopters.

No fixed-wing machine, of course, can yet completely replace the helicopter, but a V-STOL design such as the Courier can offer a substantial economy on both initial and operating costs on marginal sorties where vertical take-offs and landing are not essential. It could operate, for example, from most of the European heliports. The Courier also has an unusually good cruising performance for a high-lift type; its speed range is something like 6 : 1, compared with 3 : 1 for most fixed-wing machines, and it cruises twice as fast as most helicopters.

The first Courier to be registered in the U.K.—G-APXH—has been acquired by Autair Ltd., the helicopter charter company, to determine its practicability in supplementing rotorcraft in overseas operations. Initial experience in this country suggests that the Courier should be fully capable of realizing this potential, and I was certainly most impressed on first acquaintance with G-APXH at Fair Oaks, through the courtesy of Autair.

On that occasion the weather was ideal for a V-STOL aeroplane. It was good for very little else, with visibility down to less than one mile in places, and cloud patches at 1,000 ft. or so. During the preliminaries of the exhaustive A.R.B. flight test of the Courier, which I was privileged to observe from the back seat, it was comforting to recall the manufacturer's claims, when groping through the murk, of having produced the safest aircraft yet built.

The Helio Aircraft Corporation was originally formed by Dr. Otto Koppen of the M.I.T., and Dr. Lynn Bollinger of Harvard, to produce a STOL aeroplane with particular emphasis on safety, and initial flight trials were started with a converted Piper Vagabond. The prototype four-seat Courier first flew in 1953, and production aircraft followed in the next year.

Although of relatively conventional appearance, the Courier incorporates many novel features. It is of all-metal stressed-skin construction, but, following the findings of the Cornell Crash Injury Research, the cabin section was reinforced with an internal steel-tube structure. As a further safeguard against crash deformation, the two cabin doors are staggered; access to the front seats is via the port side, and to the rear via the starboard.

The seats themselves are both bench-type units, rigidly mounted to withstand decelerations up to 15*g*. Behind the rear bench is a baggage compartment with a 200-lb. capacity, which may also be used to provide a fifth seat if required. Removal of the rear seat leaves a 6-ft.-long compartment for carrying up to 1,000 lb. of freight.

Unlike most STOL aeroplanes, the Courier has a high-speed, rather than a high-lift, wing-section, and cantilever, instead of strut-braced, mainplanes. The NACA 23012 aerofoil profile is of laminar-flow type, and was used on the wartime North American Mustang fighter. Low-speed lift is gained by the installation of full-span automatic slats in conjunction with slotted and area-increasing NACA flaps which extend over 74% of the trailing-edge span. With slats and flaps extended, the lift coefficient of the Courier wing is approximately doubled.

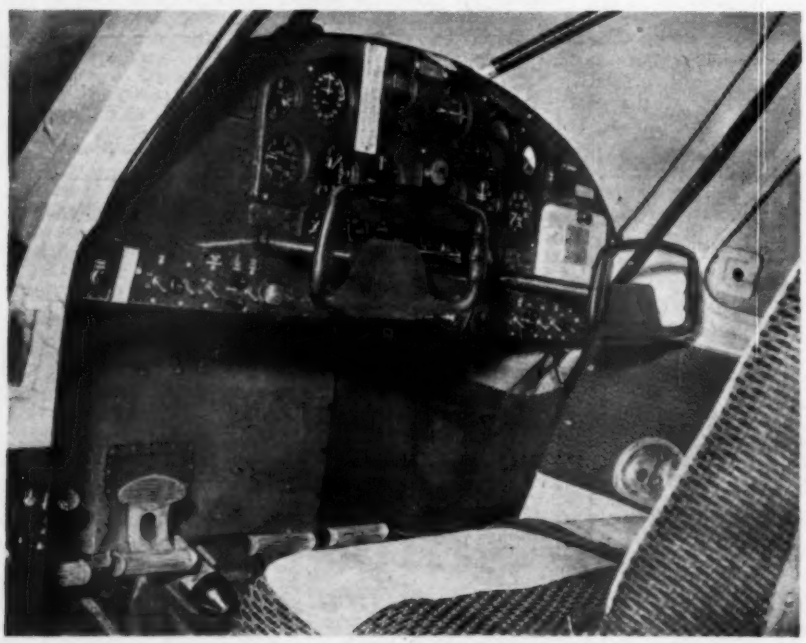
Outboard of the flaps are deep-chord low-aspect-ratio Frise-type ailerons, which are adequate for cruising flight, but for low-speed lateral control are augmented by spoilers on the upper surface of the wings. A more precise term for these devices is slat interceptors, since they comprise two curved alloy blades which emerge from slots above each wing at large aileron deflections. They then interfere with the flow through the outboard slats, thereby reducing lift and lowering the appropriate wing-tip.

Originally a British development, these interceptors are claimed to be sufficiently positive for their application at the stall to overcome the effect of full rudder, and roll the aircraft into an opposing turn.

Directional and longitudinal control are effectively achieved at all speeds by the high-aspect-ratio tail surfaces, the horizontal component of which is an all-moving or pendulum-type unit. It is fitted with trim and anti-balance tabs, the latter with a slightly vulnerable-looking fuselage arm link, and is a noticeably flexible structure. At the extreme rear of the long fuselage is the tailwheel, which in G-APXH is non-steerable.

The main undercarriage, which is set so far forward that it is impossible to nose over however fiercely the hydraulic disc brakes are applied, is fairly long to give the necessary ground angle to coincide with the maximum-lift attitude. The long-stroke oleo-pneumatic legs were based essentially on the well-tried undercarriage of the veteran Stinson Reliant, and their installation on the Courier is designed to provide progressive failure, in the event of a severe overload, to protect the fuselage.

As recommended by the Helio Corporation, G-APXH was fitted with Goodyear castoring main-wheels for cross-wind operation, but while it is true that the slower the take-off and landing speed of an aircraft, the more it is affected by drift, the Courier's performance is such that only the most marginal of strips in beam-wind conditions would appear to necessitate such equipment. For normal operations, the gear complicates taxiing.



Cockpit layout of the Helio Courier conveys no intimation of the aircraft's unorthodoxy, and conforms to Federal Aviation Agency standards.

Photographs copyright "The Aeroplane and Astronautics"

With full flap and take-off power, the Courier will unstick at 30 m.p.h., and climb away at a similar speed, while hanging on its slats.

particularly in strong-wind conditions, unless fitted with the extra facility of a cockpit-operated lock.

G-APXH is a Courier H-391B, which is the most widely produced type, powered by a 260-b.h.p. Lycoming GO-435-C2B2-6 geared flat-six engine, driving a large-diameter (8½ ft.) Hartzell two-bladed constant-speed airscrew. For high-altitude photographic survey, the H-392 Strato-Cruiser has been produced, with a 340-b.h.p. supercharged Lycoming GSO-480-A1A6, which takes a full payload to more than 30,000 ft., while the H-395 Super Courier has a 295-b.h.p. Lycoming GO-480-C1D6 and driving a three-bladed airscrew. Three Super-Couriers are being evaluated by the USAF as L-28As.

In the H-391, the Lycoming has jet-augmented exhaust cooling, combined with a noise muffler, to provide adequate engine airflow at low speeds and reduce drag. At the rear of the cabin the noise level tends to be fairly robust, since the muffler ends level with the front seats, and there was more than a suspicion of CO_2 contamination. Moving into the first pilot's seat, the noise level is toned down from exhaust bellow to engine and reduction-gear resonance, and is not excessive.

Instrument layout in the Courier conforms to the FAA standard panel, which appears to be entirely orthodox. Flight instruments are grouped on the left and engine references on the right of centre, where the throttle and pitch plungers are located one above the other. The upper lever, for pitch control, incorporates a vernier arrangement for small changes in engine speed.

Full dual flight controls are provided, with push-pull handwheels projecting from the instrument panel, and toe extensions on the port rudder pedals for mainwheel braking. On trying the controls on the ground, I noticed that the handwheels rotated through very small angles for aileron movement, indicating the potent lateral response promised by the novel control system.

On the starboard cockpit wall is the simple ON-OFF selector for the two 25 Imp. gallon wing-root fuel tanks. These have a combined gauge on the front panel.

Having settled in the front seat alongside David Parry, who has undertaken liaison with the Helio Corporation, I adjusted the curious Griswold safety harness, which goes over one shoulder rather like a Sam Browne belt, and prepared to taxi out at Fair Oaks. Although neither seat nor rudder pedals seemed adjustable, their positioning was quite comfortable. I found the thick window and door frames slightly obstructive to a good all-round view, and the acute ground angle did not help forward visibility over the nose.

With the castoring undercarriage, it is only too easy to taxi sideways, which improves ground visibility in one respect, but in virtually zero-wind conditions it was not difficult to swing the nose from side-to-side in an orthodox taxi-ing technique. On soft turf, the undercarriage gave a fairly hard ride, and an oddly unyielding impression for a STOL aeroplane.

In the cabin roof of the Courier are two concentric crank handles for flap and elevator trim operation and, as usual in American aircraft, I had slight difficulty in working out the cranking direction to apply correct bias. The larger handle requires 15 turns, according to the flight manual, to lower the full 40° of flap, but as there is no position indicator it is necessary to calculate and count the number of turns necessary for the desired setting. This lack of precision in obtaining flap positions seems to be odd in a V-STOL aeroplane.

Full flap gives the shortest take-off run, but a better climb is obtained with less and, as a novice on the Courier, I started with half. With two up and a forward C.G., the elevator trim was checked at neutral on its adjacent indicator strip, and we were all set to go.

In passing, it may be mentioned that the normal short take-off technique of opening up against the brakes does not work with the Courier, since the slipstream tends to hold the starboard inner slat (each wing has two slat sections) shut. If the aircraft is then pulled off too soon, the section remains shut, and the loss of lift causes the starboard wing to droop. No slat hang-up, however, can overpower any of the controls.

On opening the throttle to maximum power of 28 in. Hg and 3,400 r.p.m., the high static thrust of the Courier made itself felt in no uncertain manner with a very brisk acceleration. From my limited experience with STOL aeroplanes, they seem to take off best, being tail-heavy, if left to themselves.

The Courier appeared to conform to type in unsticking in the three-point attitude with virtually neutral elevator and slats clutching skywards after an absurdly short run. It did not seem to have time to show a tendency to swing, and a glance snatched at the A.S.I. revealed just over 30 m.p.h. indicated as the wheels came off the ground.

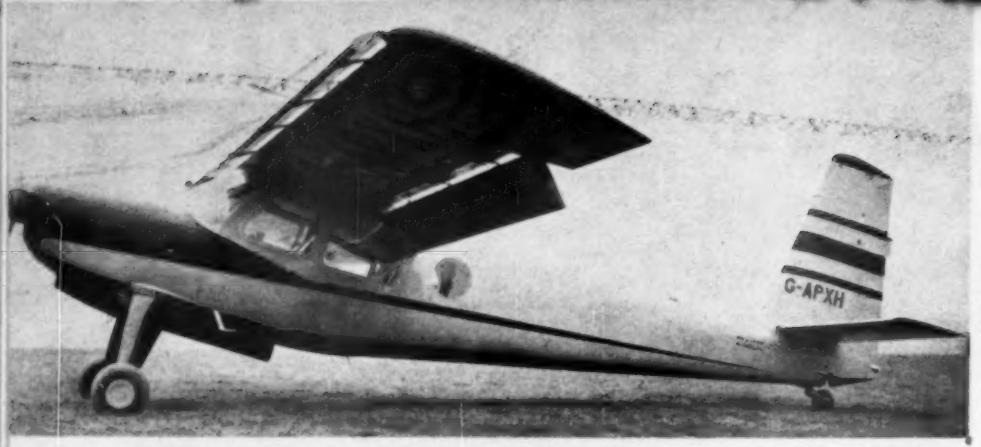
Full upward deflection of the short ailerons raises the spoilers on the same side to intercept the airflow through the outer slat and augment lateral control at low speeds.

I had previously seen how it could be climbed away, if necessary, at this fantastic figure, and a horrifying angle, although with an oddly secure feeling. Despite the fact that much of my early flying experience, including my first solo cross-country, had been on the little Zaunkœnig high-lift research aircraft, I must confess that I recalled little of the novel techniques possible with this type of machine, and contented myself with a relatively modest initial climb-out at around 50 m.p.h. The best angle of climb, with flap, is achieved at 65 m.p.h., and the en-route ascent, clean, is over 1,000 ft./min. at full load and 92 m.p.h. with 25 in. Hg and 3,000 r.p.m.

After its low-speed performance, the next most impressive thing about the Courier is the way it slips through air after being cleaned up. At the full-throttle altitude of 8,800 ft., and max. continuous power of 3,000 r.p.m., it will attain a true speed of 157 m.p.h. for a fuel consumption of 14½ Imp. gal./hr., and a range, with 30 min. reserve, of 475 miles. Economical cruising speed, at 2,600 r.p.m. and the rated altitude, is 145 m.p.h. T.A.S. for only 11 gal./hr. consumption, giving a range of 582 miles.

Never-exceed speed is well above the cruising range, at 189 m.p.h., and a dive up to 170 m.p.h. I.A.S. showed no adverse features. As one would expect from a STOL aeroplane, stability during the climb and cruise is pronouncedly positive, although the generous tail surfaces for the low-speed case did not appear to produce any untoward symptoms higher up the scale.

In cruising flight, the Courier handled much like any other



The full-span automatic slats and slotted area-increasing flaps of the Courier combine to give it a a near-helicopter performance. Low-speed control and stability dictate the shape and size of the fin and rudder, and slab tailplane.

good, although more conventional, light aeroplane. The ailerons bore out their promise of crispness with small handwheel movements, and moderate forces, to which a certain amount of static friction in the circuit contributed. As the murky air was lifeless, it was not possible to assess the amount of gust feedback through the large control surfaces, compared with other STOL aeroplanes, but the Courier exhibited neither buffet nor marked trim changes throughout most of its flight.

Longitudinal response provided no evidence of the unconventional control surface, and harmonized well with ailerons and rudder. The latter was rather lighter at cruising speeds than is perhaps customary, but came in for very little use. The short, deep ailerons appear to produce accurate turns in each direction with quite small deflections, and unaugmented rates of roll of about 55°/sec. In brief, the Courier proved very pleasant to fly, with light and responsive control allied to good all-round stability.

These characteristics were maintained at reduced speed, as I had earlier observed when a relatively clear patch of weather had been found for the A.R.B. tests. Minimum flight speeds were then thoroughly explored at a comfortable height, but although it was shown that the Courier can be made to stall positively, under certain conditions, despite its restricted elevator movement, the loss of altitude involved is negligible.

There are very small trim changes with power, and the low-geared elevator crank handle, once you have worked out which way to wind, is precise and sensitive. Flap limit speed is 80 m.p.h., and as you begin cranking them out there is the usual mild nose-up pitch. The Courier then seems to trim itself with continued flap extension, and slat opening does not seem to affect the aircraft attitude. The slats begin to pop out with a healthy "clonk" at just under 60 m.p.h. I.A.S., in a positive sequence of port inner, starboard inner and then the two outer sections.

No effect on lateral control or stability was noticeable during their asymmetric opening; with full flap extended, and power off, the Courier then sank evenly in a nose-high attitude at less than 50 m.p.h. I.A.S. In the same configuration, with a little power, a yaw to port began at about 45 m.p.h., and with the wheel hard back, very slight elevator buffet indicated the edge of the stall breakway, at 39 m.p.h. I.A.S.

Even at these very low speeds, all the controls remain quite positive, although there is the usual heavying-up of ailerons, and the rate of roll is about half that at cruising speed. Full rotation of the handwheel is needed to achieve this lateral response, but the "feel" of the slat interceptors is quite normal. If the control column is held hard back at minimum speeds, the nose will gently see-saw up and down while the aircraft sinks at a rate precisely controlled by the throttle.

The slats do not retract until the airspeed builds up to about 70-75 m.p.h., so that their actuation is clear of the band of STOL approach speeds. With no flap or power, however, the outer slat sections are not fully extended at the minimum flight speed, which is heralded by a slightly disconcerting lateral rocking through aileron snatch before the mild breakway at about 60 m.p.h. I.A.S. One other slightly unusual phenomenon which manifested itself was a healthy vibration of the pendulum tailplane through buffet in a flaps-up sideslip.

In a design such as the Courier, engine power plays a particularly important part in the achievement of controlled low-speed flight. Although minimum indicated airspeeds in stall exploration were no lower than 39 m.p.h., several take-offs proved that with full throttle and flap the Courier could climb vigorously away under full control at a rock-steady 30 m.p.h.

It is quite possible, although serving no useful purpose, to get a zero indication on the low-reading A.S.I. With no fully developed stall, its manufacturers claim that it is impossible to spin, which is another of its safety sales features.

To make full use of the Courier's low-speed performance for landing requires a certain amount of familiarization, since the flap system is claimed to be about three times as effective as the most heavily flapped conventional aircraft. The manufacturers recommend starting off with half flap and a power-off approach speed of 65-75 m.p.h. for an entirely normal landing, which with the responsive elevator certainly presents no difficulty. The slats pop out just at the point of flare-out, but with no noticeable effect.

With full flap, mainplane lift is roughly doubled but there is four times as much drag compared with the clean wing. The full 40° of flap is lowered progressively as the speed falls below 80 m.p.h., the effort required on the crank handle reaching a peak at about the half-way setting.

With the Courier trimmed positively at 50-55 m.p.h., about 10-12 Hg. of throttle reduces the high rate of descent and is a suitable basis for adjustment for the optimum approach path. It also brings the aircraft to an approximately level attitude, but because of the high flap drag, power must be maintained throughout the flare-out until the wheels touch the ground.

This, of course, is a slightly foreign technique for most pilots, and I found a little difficulty in making a tidy arrival. The aircraft is sinking fairly rapidly, and last-minute power adjustments are usually necessary to cushion the descent, since solely applying up elevator for the flare-out merely alters the attitude.

As the three-point angle is rather acute, a fair amount of co-ordination seemed to me necessary to achieve a smooth and soft landing. I found it regrettably easy to make a "wheely" touch-down, which the continued power application tended to magnify into a bounce.

This appears to be a fairly common problem on initial acquaintance with the Courier, but it is apparently soon overcome, and my third landing in G-APXH was quite passable. With practice, the Courier can be brought in as slowly as 35 m.p.h., in a very nose-high attitude, but this requires skilful and liberal use of power to cushion the final descent. Alternatively, it is possible to make a power-off full-flap approach at 60 m.p.h., for a very low "no-float" flare-out.

Once down, the brakes can be applied as fiercely as desired, and a typical nil-wind landing run is 50-60 ft. This means that the Courier can operate from less than the width of a normal runway, in the hands of a pilot used to its handling, and the only thing a complete novice is likely to hurt in attempting similar feats is his pride.

The Courier certainly seems completely viceless, and even a simulated overshoot when trimmed at 1.3 Vs (65 m.p.h.) with full flap produced only a mild nose-up pitch effect. For so powerfully flapped an aircraft, the Courier suffers remarkably little trim change, presumably because of its pendulum tailplane.

On floats, it apparently confers its V-STOL performance to water operations, and the degree of expertize required for these or its landplane use is small compared with the advantages offered. It is possible, however, that short landings could be made considerably more comfortable by providing the present rather hard undercarriage with Liquid-Spring type of shock absorbers and lower-pressure tyres.

The Courier has proved itself a remarkable and successful example of design and engineering, and for the performance range which it offers its initial cost of about $30,000 f.a.f. is not high. Of this total, its manufacturers consider that its special features account for some $11,500.

Estimated U.S. overall operating costs, excluding pilot salary, for an annual utilization of 600 hr., are $23.00 an hour. This is less than half the minimum operating costs of the average small helicopter, which has three seats compared with the Courier's five.

Leading Particulars (Super Courier in parentheses)

Dimensions.—Span, 39 ft. 0 in.; length, 30 ft. 0 in.; height, 8 ft. 10 in.; wing area, 231 sq. ft.

Weights.—Empty, 1,960 lb. (2,037 lb.); fuel (50 Imp. gal.), 349 lb.; oil, 18 lb.; pilot and passenger, 340 lb.; two passengers, 290 lb.; baggage, 43 lb.; max. payload, 1,620 lb. (1,883 lb.); max. gross, 3,000 lb. (3,920 lb.).

Performance.—Max. cruise, 162 m.p.h. (170 m.p.h.); economical cruise, 145 m.p.h. (146 m.p.h.); initial climb, 1,124 ft./min. (1,550 ft./min.); service ceiling, 23,100 ft. (23,500 ft.); minimum level speed, 30 m.p.h.; take-off distance to 50 ft. (57 m.p.h.) nil wind, 542 ft. (475 ft.); landing distance, from 50 ft. (40 m.p.h.), 580 ft. (493 ft.); range, 582 miles (842 miles).

The Fighting Services

North American Tour

THIS year's annual R.A.F. Staff College lecture tour of U.S.A.F. and R.C.A.F. colleges starts later this month. Led by the Commandant, Air Vice-Marshal M. L. Heath, the College officers are presenting their views on current military matters to the U.S.A.F. Command and Staff College, Maxwell Air Force Base, and the R.C.A.F. Staff College, Toronto, before returning to the United Kingdom on April 13.

Accompanying Air Vice-Marshal Heath will be Gp. Capt. J. N. Stacey, Gp. Capt. C. N. Newman, and Wg. Cdrs. D. R. Locke, L. E. Laughton and H. M. H. Tudor. With them in the U.S.A. and Canada will be Lt. Col. O. A. J. Kemper, U.S.A.F. Liaison Officer at Bracknell, and, for the Canadian part of the tour, Wg. Cdr. A. F. Green, R.C.A.F., Liaison Officer at Bracknell.

R.A.F. Gliding Prospects

FOLLOWING the 1959 record of 39,911 launches, 5,332 hours' flying and 13,895 miles in cross-country flights, the R.A.F. Gliding and Soaring Association is looking forward to another successful season. With a present total of 13 clubs, and three more due to start operating in the near future, the Association has arranged an interesting programme of competitive events for the summer.

The Inter-Command team and individual gliding contests will be held in the second half of July, and the Inter-Service team and individual championships in the last week of July (Inter-Service gliding championships were held for the first time last year, with the R.A.F. the initial winners). Concurrently with the Inter-Command contests there will be held inter-club and individual competitions for R.A.F. glider and sailplane pilots. All these events will be at R.A.F. Odiham.

This month members of the R.A.F.G.S.A. are to take part in some gliding research in the Pennines. The Association is arranging for parties of R.A.F. personnel to assemble near Carlisle to explore the helm wind waves over the Pennine Chain. When the wind is easterly or north-easterly it reaches quite remarkable force under certain conditions. Among members who will be in Cumberland during this period are Air Chief Marshal Sir Theodore McEvoy, the Air Secretary, who is president of the Association, and Gp. Capt. R. R. Goodbody, O.B.E., chairman of the Association. Instructor in charge of the R.A.F. parties will be Gp. Capt. N. W. Kearon, deputy chairman of the R.A.F.G.S.A.

Building Up the Hours

SINCE the start of the Malayan emergency in June, 1948, No. 656 Light Aircraft Squadron of the Army Air Corps has logged approximately 230,000 hours of flying in the Far East. Of this total, some 187,000 hours have been on operational sorties in Malaya and Korea; training, air tests and demonstrations have accounted for over 40,000 hours.

The Squadron was re-formed at Sembawang, Singapore, soon after the start of the emergency in Malaya and comprised a Headquarters Unit and four flights—Nos. 1902, 1903, 1907 and 1914. Later No. 1903 Flight was moved to Hong Kong and then to Korea, and in the middle of 1950 a new flight—No. 1911—was formed. This flight later became the first unit to have men of the Glider Pilot Regiment on its strength serving with powered aircraft.

With the formation of the Army Air Corps on September 1, 1957, the Squadron ceased to be part of the R.A.F., although servicing was undertaken by the latter's ground crews until the middle of 1958. In September, 1958, No. 16 Reconnaissance Flight was formed to bring the Squadron total to five. It was also the first flight to be formed since the creation of the A.A.C.

The tasks of No. 656 Squadron have been many and varied. They have included visual and contact reconnaissance; casualty evacuation; leaflet dropping; reconnaissance of helicopter landing grounds and supply dropping; and target marking for the R.A.F., R.A.A.F. and R.N.Z.A.F. Over 80,000 visual reconnaissance sorties have been flown by the Squadron since 1948, together with the dropping of some two million leaflets and approximately 8,000 general reconnaissance and supply-dropping missions.

As already mentioned, aircraft servicing was, until 1958, undertaken by R.A.F. ground crews, but it is now the responsibility of R.E.M.E., with the R.A.O.C. supplying the stores. The flights of the Squadron are based at Noble Field, Kuala Lumpar; Seremban, Ipoh; Taiping; and Sembawang, Singapore. The Austers have been parked in the open, subject to all the rigours of the Malayan climate, for most of their time on the ground. The servicing and repair facilities have been rudimentary, but, despite this, the ground crews at each base have succeeded in achieving a high level of serviceability.

OVER THE ULU.—An Auster of No. 656 Light Aircraft Squadron, A.A.C., carrying a special marker bomb over the mountainous jungle of central Malaya.

The Squadron Headquarters is based at Noble Field with No. 16 Flight, which operates in support of the Third Federal Infantry Brigade and is also responsible for all flying training. The collapse of the Communist terrorist organization during 1958 brought to a successful conclusion many operations in south and central Malaya. This development caused a redeployment of aircraft and No. 7 Flight, in support of 28 Commonwealth Infantry Brigade in north Malaya, was reinforced, whilst No. 2 Flight, already in support of the Second Federal Infantry Brigade in Perak, was put in support of the First Federal Infantry Brigade at Alor Star.

Nos. 11 and 14 Liaison Flights are concentrated in the training rôle, although occasionally they assist in operations in Pahang.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. F. R. Bird, D.S.O., D.F.C., A.F.C., and Wg. Cdr. C. B. Owen, D.S.O., D.F.C., A.F.C., both to the Department of the Chief of the Air Staff; Wg. Cdr. I. F. Easton and Wg. Cdr. W. J. Nightingale, both to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr. C. E. Ness, O.B.E., to R.A.F. Waddington and Wg. Cdr. R. G. B. Summers, O.B.E., A.F.M., to R.A.F. Finningley, for operations duties; Sqn. Ldr. E. R. G. Haines, M.B.E., D.F.M., to Headquarters for operations staff duties, with the acting rank of Wg. Cdr.

Technical Training Command: Wg. Cdr. J. R. Coulson to be Deputy Provost Marshal, with the acting rank of Gp. Capt.; Wg. Cdr. C. T. W. Morgan to R.A.F. Kenley to command the administrative wing; Wg. Cdr. F. Vernon, M.B.E., to R.A.F. Brampton, to command.

Other Appointments: Gp. Capt. G. W. Petre, D.F.C., A.F.C., to be President of the R.A.F. Selection Board, Cranwell; Wg. Cdr. P. M. Chettle, B.Sc., to the Wright Patterson Air Force Base, Ohio, U.S.A., for an exchange tour of duty with the Weapons Components Division.

More Service News

No. 98 Squadron.—Past officers and S.N.C.O.s of No. 98 Squadron will be interested to know that a Squadron Association was formed recently. The first reunion will be held in London on July 15 and all details can be obtained from the Commanding Officer at R.A.F. Driffield, East Yorks.

No. 46 Squadron.—The 43rd Officers' Reunion Dinner of No. 46 Squadron will be at R.A.F. Waterbeach on April 23, with the traditional Ladies' Luncheon on the following day. At the luncheon a presentation will be made of an original painting depicting Sopwith Pups of No. 46 Squadron before the Battle of Cambrai. Further particulars of both occasions will be gladly supplied by Sqn. Ldr. P. Gifkins, R.A.F. Linton-on-Ouse, Yorks.

The Commonwealth's Cape Canaveral—2

In this concluding part of his report on Woomera, WREN *describes various live firings. A two-page map of the Establishment appeared last week.*

ON the way from Adelaide to Salisbury, one passes the new town of Elizabeth, so it seemed logical for loyal Australia to name Salisbury's aerodrome Edinburgh Field. Gp. Capt. D. R. "Jel" Cuming, O.B.E., A.F.C. and Bar, the Station Commander, flew a Canberra in the England-New Zealand race. As he kindly showed me round his handsome station I was impressed, not for the first time, by the Britishness of this great W.R.E. combined operation. The only visible evidence of the American touch was the presence of F-86 Sabres and even these were built by the Commonwealth Aircraft Corpn., as were the majority of their Rolls-Royce Avons. Other Commonwealth aircraft associated with W.R.E.'s work are the Australian-built Canberra and the Jindivik target aircraft, the Bristol Freighter and Sycamore, the Meteor, Beaver and Otter, all operated by the R.A.A.F. with support from the R.A.F. in the shape of the Comet, Hastings, Britannia, Valiant and such visiting aircraft as the Victor and Vulcan.

R.A.A.F. Edinburgh consists of a Base Sqn.; a Maintenance Sqn., who carry out the servicing, modification and preparation of target aircraft operating from Edinburgh; No. 2 Air Trials Unit, responsible for mounting all air-to-air trials, bomb ballistic trials and flying associated trials equipment to the Range Area; No. 8A Joint Service Trials Unit, carrying out Thunderbird trials; No. 12 J.S.T.U., Firestreak trials; and the Air Transport Section, passenger/freight handling, including that for Comets, etc., and their maintenance. The R.A.F. have an administrative Support Unit, a Holding Unit for the Maralinga atomic weapons trials, and No. 76 Sqn. (Canberras), which provides support for these trials, is also based at Edinburgh.

At Salisbury, I had been shown something of the headquarters, laboratories and workshops of both W.R.E. and the contractors, where the assembly, testing, modification and development of missiles, instrumentation, etc., are carried on. And here tribute must be paid to the vital part played by R.A.E. back in the U.K. where, in collaboration with contractors and the Services, the basic research and initial development is done before W.R.E. take over.

With a broad appreciation of a missile's progression up to this stage, I was now to see the end product—the weapon in action. From Edinburgh Field a daily courier service to Woomera is operated by a TAA-owned and crewed DC-4 leased to Guinea Airways. The old lady, who probably had more hours than Big Ben, ambled north-westwards carrying along with me a full load of Woomera staff, 300 miles over hilly pastures, then great stretches of sheep country, until dazzling white salt lakes marked the final approach to the Range's prohibited area.

Woomera

There are probably those among us who do not know that a "woomera" is an aboriginal spear launcher-cum-booster carved from wood, with a hand-grip at the front end and at the other a spike which locates in a hole in the spear's base. Simple and effective. Now the white man has his own Woomera, effective if not simple.

On arrival at Woomera airfield, my first reaction was exhilaration at the weather — cloudless, a blazing sun tempered by a soothing breeze, the far, flat horizon as clear as the foreground, conditions which so strongly influenced the choice of this area. Less than 10% of scheduled trials are delayed by adverse weather. Other advantages are that, being a land range, it makes missile recovery possible (99% so far).

In the beginning there were literally no buildings and no facilities other than the Trans-Continental Railway. There was virtually unlimited land available on which to build the Range-head, the airfield and the village. The popular conception of the desert as a flat, sandy waste doesn't apply to Woomera. Stretching out from the railway there are about a thousand square miles of gently undulating stony plateau country, covered only with small succulent bushes and a little grass; farther up the Range there are regions of this type of country alternating with sandhills covered with low scrub.

An airfield site was chosen about five miles north of Pimba railway station and a railway spur built into this area; the village was then sited between the airfield and the railway, and the Range-head was sited about 20 miles from the village. Because of the terrain it was possible to make theoretically

WALTER McDOUGALL
Native Patrol Officer
ALAN READ
Principal Officer, Range Admin.
Maj. JOHN HOTHAM
O.C. Army G.W. Trials Unit & Chairman of Woomera Village C'ttee.
Col. RICHARD DURANCE
Range Superintendent
TOM DALTON-MORGAN
Officer i/c Range Operations
"Which one is it, Eddie?"
"Ten,000 sheep on the Range — and a million kangaroos."
TONY JAY
Range Overseer
Gp. Capt. D.R. 'JEL' CUMING O.C. RAAF Edinburgh
W.R.E.'s RIDERS of the RANGE
by Lorraine
Wg. Cdr. DON McCORD O.C. No.1 Air Trials Unit
PETER MORAN
Principal Officer, Satellite Tracking Station
EDDIE HATT
Security Officer

"THE RANGE RECOVERY BOYS SAY IT'S AN ABRO 3-STAGE MISSILE CODE-NAMED 'BLACK BOTTOM'— PERSONALLY, GENTLEMEN, I HAVE MY DOUBTS."
TOM WOOLCOCK Chief Admin. Officer
DR. M.W. WOODS Dep. Controller W.R.&D.
R.W.M. BILL BOSWELL Controller
HAROLD LOXTON Dep. Controller Planning
ARTHUR WILLS Dep. Controller Trials & Instrumentation Wing
MEN OF SALISBURY – The W.R.E. EXECUTIVE.

ideal designs for the Range-head and to transfer these directly on to the country. Natural features have never impeded or caused alteration in Range layout.

The climate is hot and dry (less than 5 in. of rain has fallen in the past 12 months) and affords an average of 3,300 hours of sunshine per year. This makes it possible to exploit optical as well as electronic instrumentation; in consequence much original work in optical instrumentational development has been done in Australia.

For economic reasons, less than 25% of the W.R.E. staff are employed at Woomera—in professional grades, 10%—due to locating the development labs., etc., at Salisbury. Even so, Woomera has a population of some 3,000 men, women and children. As much as possible of the equipment is automatic in action and capable of operation by the minimum number of personnel. By good design the requirement for operating skill has been reduced, enabling recruitment of Woomera housewives to operate optical and electronic equipment.

My guide was Eddie Hatt, security officer, to whom, for his informative help, we wraise our hat. He took me to the Range Superintendent, Col. Richard Durance, Australian Army, who welcomed me and arranged that I should see as much as could be seen.

Then, in the inevitable Holden, Australia's own car, we motored the few miles to the non-residential Senior Mess on the outskirts of Woomera village. In the course of that pleasant evening I renewed my faded recollections of the village. Within the limits of practicability and cost, it has almost every amenity —school, three churches, shopping centre, cinema, swimming pool, every kind of sport, club and society, but no hotels—visitors, who must be sponsored, are accommodated in a simple, pleasant room in a residential quarter.

The next day was another "beaut"—cloudless, hot, and just enough wind to keep the flies away without raising the dust. Telephone and power lines and the water pipe line ran parallel to the 20 miles of road to the Range-head.

First view of the "heart" of Woomera was the Skylark's 80-ft.-high tower, fabricated from Bailey bridge panels, rising above undulating ground.

On the Range-head the freely available space has been used to separate the work.ng buildings from places where dangerous operations take place, and the minimum number of protected buildings have been installed. There is a line of three launching sites (one has two pads), each separated by a distance of 600 yards; thus, when the explosives are being handled on one launching pad, work can proceed in reasonable safety on the other two. The instrumentation is located 1,000 yards behind the launchers and, where possible, is located in the Instrumentation Building. Optical instrumentation such as kine-theodolites requires a geometric plan and these posts are located on a road running past the building and north of the firing direction so that the sun is normally behind the operators.

Behind the instrumentation road the contractors occupy a series of test shops where they make their final preparation, and to the rear again of these are common facilities such as fuel and explosives stores, magazines and boosting shops. This layout enables the missile contractors to have free access to their shops and to proceed with trials preparation without impeding any of the measurement work which may be in progress in front of the instrumentation road.

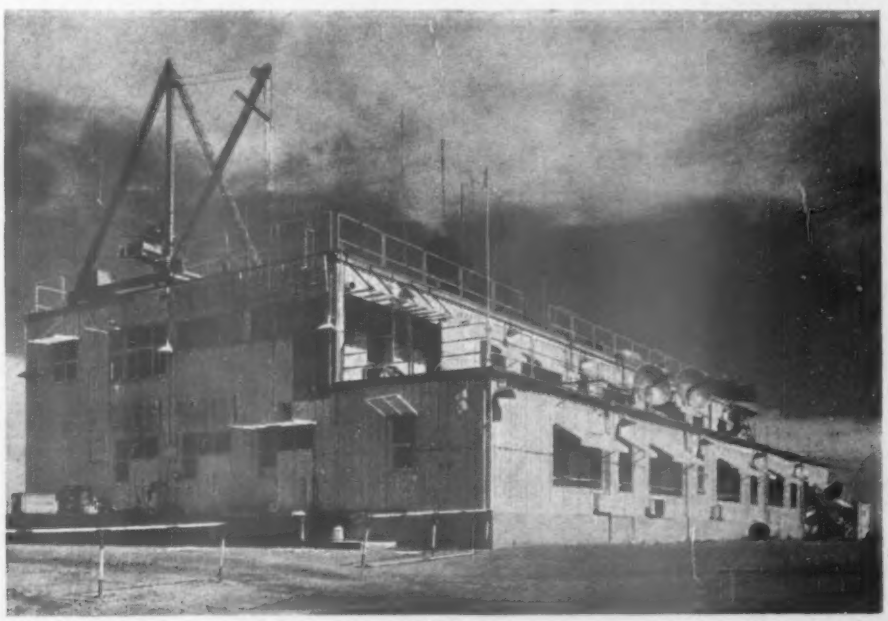
Passing the workshops area, with blackened and bent missiles and boosters lying around, we went up to the Skylark site. Sixteen firings had been made here, with only one rocket failure. This record and the simplicity of the set-up seemed to me to typify the Commonwealth's success in achieving their aims in the most economical way.

Firestreak v. Jindivik

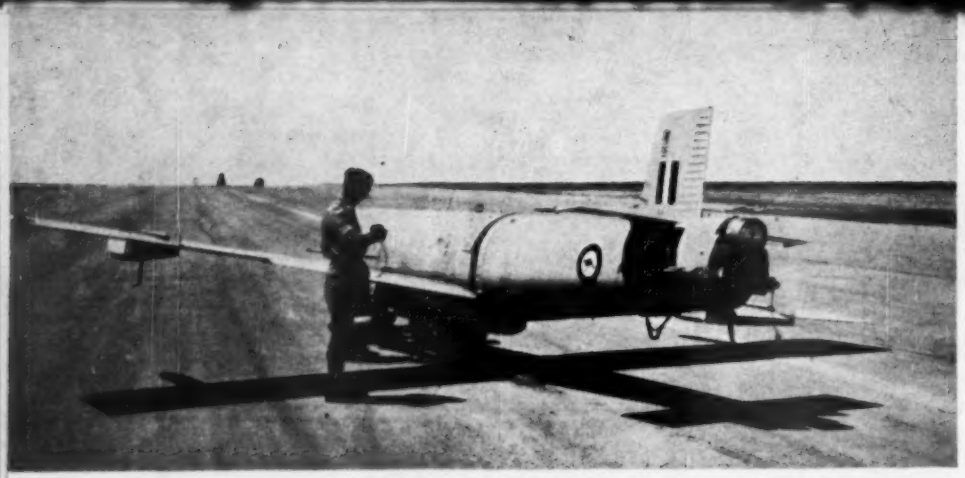
Across Instrumentation Road to Evetts Field for the most interesting demonstration of my visit, a complete Canberra-Firestreak-Jindivik operation. Wg. Cdr. Don McCord, R.A.A.F., commands No. 1 Air Trials Unit, the only unit at this airfield and equipped with Jindivik and Meteor target aircraft and Bristol Sycamore helicopters; these last-named can transport personnel and modest loads and in this way back up the Jeepborne Recovery Unit.

Don took us out near the runway where a Jindivik 2 was poised pointed into wind on its trolley, with its servicing vehicles lined up abreast of it. Jindivik (aboriginal for "the hunted one") is a product of Australia's Government Aircraft Factory, the design team being led by Ian Fleming, now the D. of S.'s Controller, Aircraft and G.W. Supply.

A few minutes of waiting, then "It's off!" and the small, pilotless monoplane, thrust on by a Bristol Siddeley Viper 3, gathered speed, and after about 3,000 ft. lifted off its trolley at 115 knots and climbed smoothly into the clear blue yonder until only its flashing white location light, set above the tail



NERVE CENTRE.—The Instrumentation Building, Range E, Woomera, from which control is exercised over all firings.



MISSION COMPLETED.—A Jindivik 2 at rest at Evett's Field. The two clusters of magnesium flares alongside the jet and below the tail-light, are an additional heat source. The boomerangs on the fin record sorties made. Below, another Jindivik Mk. 2 target aircraft rises from its trolley.

pipe, could place it. The trolley didn't perform as immaculately—uneven brake pressure swung it to port off the runway to turn over in a cloud of dust.

In the flight control centre, which resembled a power station with aerials, we went into the control room, where three R.A.A.F. aircrew were flying an aeroplane they couldn't see. They sat at control panels quietly watching tell-tale doll's-eye lights and flight progress instruments and occasionally correcting the Jindivik's course and attitude. One kept a constant check on fuel consumption rate against height, time, and engine revs.

Don invited me to put on a headset—the Canberra pilot's commentary on height, speed and range was terse. He had come up from Edinburgh armed with a Firestreak and nice timing all round had brought him to a perfect rendezvous with his target.

About 20 minutes later, when both were overhead, we went outside to watch the climax in perfect conditions. In the stark blue sky, at 40,000 ft., a tiny white cross was being slowly overhauled by a larger one, both laying a brief contrail. A loudspeaker boomed the pilot's voice over the hot airfield—"Range 2,000 . . . 1,800 . . ."—no other sound came down to us. Closer—surely, *now* . . . suddenly a flash, a white puff, the missile streaked ahead of the Canberra, an explosive boom reached us. Alas, W.R.E. asked me, before the event, to refrain from reporting the outcome of any firings I saw, so my lips must remain sealed.

However, I can report the conclusion of a Jindivik operation which took place before lunch. The little jet descended for a downwind run almost parallel to the runway, reminiscent of an S.B.A.C. Display fly-past, and, because one knew that no pilot was actually in it, one endowed the actual aeroplane with some sort of personality. Two miles downwind it turned and began its approach, at which point the controllers in Flight Control hand over to a "pilot," stationed near the runway threshold, who controls height and gliding angle, and a "batsman," at the upwind end, who has azimuth control. With flaps and skid down the yellow Jindivik landed perfectly along the runway centre-line, finally sinking, glider fashion, on to a wing-tip skid. A triumph for all concerned. More than 600 successful flights have been made.

The Jindivik family tree:—

Mk. 1: Made 50 flights; out of service.

Mk. 2: Armstrong Siddeley Viper 3; standard model in service.

Mk. 2a: Wider span, different air intake, Mk. 4 camera pods; in service.

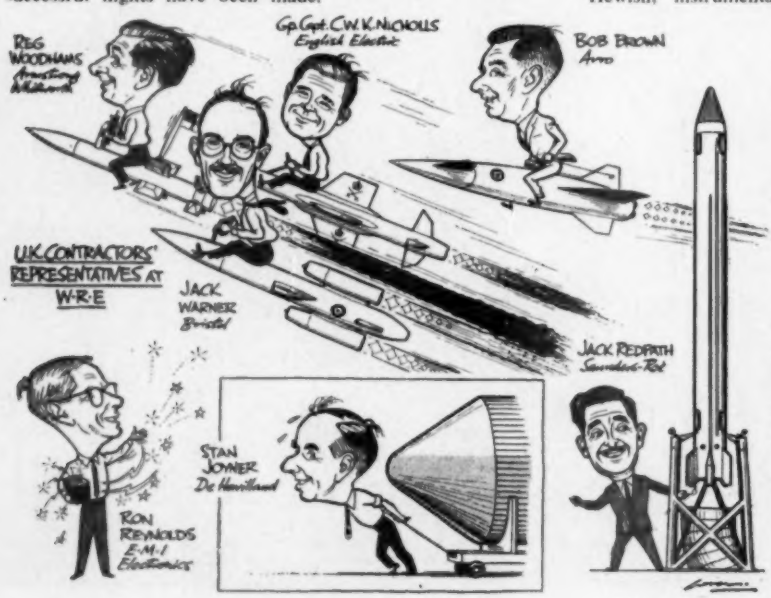
Mk. 2b: As 2a, with ASV 8.

Mk. 3: As 2a, with ASV 11.

Thunderbird v. Jindivik

After lunch in the Range-head cafeteria, a visit to the "nerve centre," the Instrumentation Building, from which I was to see a Thunderbird ground-to-air missile fired. Inside, it was like an operations room with lights, hundreds of them in rows on control panels mounted in front of controllers who sat at consoles raised above floor level at one side of the control room.

I met Tom Dalton-Morgan, an ex-R.A.F. fighter pilot, who is officer i/c Range Operations; Charles Alderson, the Range control officer; John Walton, trials control officer—he arranges the programmes; and, to my masculine surprise, Barbara Hewish, instrumentation control officer, who handles the reporting from the central timing unit.


REG WOODHAMS Armstrong Whitworth
Gp Capt. C.W.K. NICHOLLS English Electric
BOB BROWN Avro
U.K. CONTRACTORS' REPRESENTATIVES AT W.R.E.
JACK WARNER Bristol
JACK REDPATH Saunders-Roe
STAN JOYNER De Havilland
RON REYNOLDS E.M.I. Electronics

In words of one syllable, Tom Dalton-Morgan explained some of the centre's workings. They use a 24-channel communication net system and, as I could hear for myself, individuals were able to talk to each other over the system, reporting progress in preparation, commenting, asking questions and even holding a conference. The centre sets up the trial, sends the timing to all posts and, when everything's ready, initiates the operation. "Once we set the operation in motion, everything progresses automatically and the missile fires itself."

There were now only a few minutes before the Thunderbird was to be fired. From the sunlit balcony outside, one could see the missile on its pad, solitary and ominous. Above, there was a Jindivik which had a date with destruction. Trail-less, it was scarcely visible. Ten seconds . . . Zero. A thin trickle of black smoke for a second. Then almost too quickly for the eye to follow, the missile flamed upwards with a crack of thunder. At around a thousand feet, the four boosters "petalled" off (wonderfully descriptive term); the missile, now on its own, followed its initial course briefly, then (thinks: "Ah, there's that

Women operate kiné-theodolites at Woomera.

target") turned abruptly under radar guidance towards the Jindivik. Up, up, then . . . (Don't miss our next thrilling instalment). To measure missile performance W.R.E. use cameras capable of speeds of 2,000 frames per second and of yielding positional accuracies of one foot at 60,000 ft. altitude.

Situated about a mile to the west of the main launching area, the Black Knight site was next visited. At first, the only sign of life there was two kangaroos and I felt that Eddie Hatt might have misquoted the old song: "Come into the garden, Chris, for the black, black night hath flown." Again, the impression was of simplicity with sufficiency. Two identical pads and gantries ensure continuing serviceability if one site should be put out of action by a mishap. However, this research vehicle has worked faultlessly, as you know.

Satellite Tracking Station

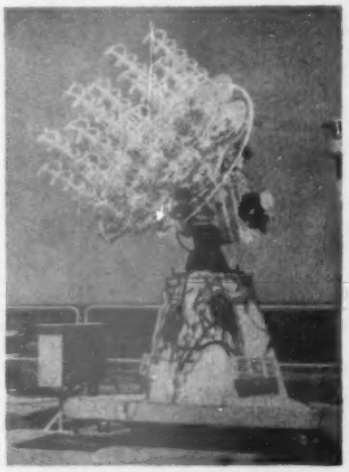
Completing a full and fascinating day, we called at what is probably the most successful of the 12 satellite tracking stations of this type which are distributed around the World. Two systems are used:—

(i) The Baker-Nunn camera. Since its installation at Woomera in March, 1958, this camera has achieved a consistently higher success rate than any of the other 11 similar stations—which means that it has achieved a greater percentage of possible sightings. The first photographs of four of the American satellites were obtained at Woomera (Explorer VI, called Paddle Wheel, at over 5,000 miles); and the station holds two important distance records: The "Paddle Wheel" satellite was photographed at a distance of *14,500 miles*, and Vanguard I, the "Grape Fruit" satellite, only 6 in. in diameter, was photographed at 2,500 miles, demonstrating a capability one magnitude greater than the camera designer intended.

(ii) Minitrack. The Woomera staff have been congratulated by the National Aeronautics and Space Administration on having the best maintained of the 10 Minitrack installations. The station has retained its accuracy to within 20 seconds of arc throughout the 21 months of its operation and obtained the first passages of three of the American satellites. The Minitrack phase comparison system of the radio tracking of satellites is also used for recording telemetered information from both American and Russian satellites and for interrogation facilities for some American satellites.

Although the main body of the station's equipment is thus American, Peter Moran, its principal officer, and his staff are all-Australian and clearly on the ball, if I may say so. They are characteristic of the many capable, friendly Aussies who, in co-operation with their U.K. counterparts, have made Woomera and its products a power in this world of missiles and space research.

SATELLITE WATCHER.—The set-up at Woomera of the the Minitrack installation which has a remarkable record of successful operation.



TAFE.—The involved aerial array of the telemetering automatic following equipment.

Midas and Samos

A NEW phase in the development of artificial satellites, this time in a military rôle, opened on February 26 when the newly developed Atlas-Agena B rose from its launching pad at Cape Canaveral. It was the first attempt to orbit the Midas satellite—short for Military Defense Alarm System—but unfortunately the second stage refused to separate and the satellite did not go into orbit.

Midas is regarded as a logical extension of the "radar fence" which is being set up in Alaska, Greenland and England, for the detection of ICBMs over long range.

Although Midas is at present merely in the research and development phase, the U.S.A.F. hopes to have 20 satellites of this kind in orbit at an altitude of about 200 miles by 1964, and with their aid, to extend the time of advance warning of ICBM attack from 15 to 30 minutes. Midas will carry detectors which are sensitive to infra-red radiation and it is anticipated that these will be able to locate the exhaust of a hostile missile soon after it leaves the launching pad. Indeed, once the system is fully operational, it should be impossible for any nation to carry out long-range missile testing without precise information being available to the United States.

Both Midas and a companion satellite intended for "photographic surveillance" have been under development by the Lockheed Aircraft Corporation for some time as a branch of the Discoverer-Agena satellite programme in which attempts are being made to recover a 300-lb. re-entry capsule from orbit. The photo-surveillance satellite has gone through many development stages since it was first conceived, first under the name of Pied-Piper, then Sentry, and now Samos.

Little up-to-date information is available on this project but it was originally said to be designed to carry detector instruments and cameras. First experiments were to determine the effect of dust and haze on photography and it was apparently intended to recover conventional film cameras by means of a capsule, similar to that of the Discoverer programme.

A polar close-orbit was envisaged for surveillance operations.

The importance of satellites in military intelligence and strategy was emphasized by Lt.-Gen. Bernard A. Schriever when he dedicated America's new satellite test centre at Sunnydale, California, last month. Artificial satellites, he said, have a great future for the detection of missile launchings, in keeping missiles under immediate surveillance and in facilitating communications between dispersed forces around the Globe.

Agena-B

The key to these new military ventures is the Lockheed Agena-B which represents both the second-stage launching system, plus fuel reserves for orbital manœuvring, and the satellite payload. It is, in fact, a development of the Discoverer-Agena satellite with an increased propellent load and other propulsion refinements which permit the 15,000-lb.s.t. engine to be restarted and stopped in orbit. The first stage is an Atlas.

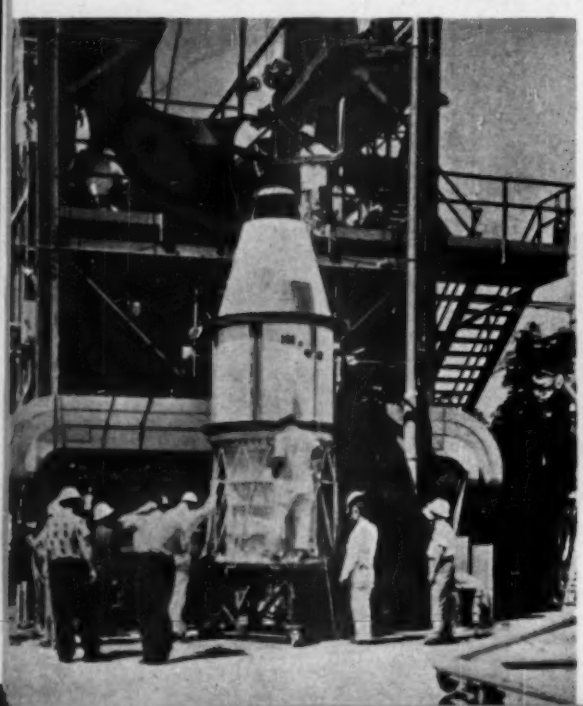
The great advantage Agena-B offers over its predecessor is the ability to restart its engine as a means of modifying the orbital path. This can be done by programming equipment within the vehicle or by radio command from a ground station.

To restart, the turbine-pump is spun-up by firing a solid-propellent charge. Solid-propellent is also used to pressurize the tanks under zero-g conditions.

Launched into an orbit which initially is elliptical, the vehicle's rocket engine can be restarted at the apogee to transform the path into a high-altitude, near-circular, orbit.

Details of the Discoverer-Agena programme, which is playing a large part in proving basic orientation, control and propulsion equipment for the Midas and Samos satellites, were given in THE AEROPLANE AND ASTRONAUTICS, January 1, 1960, pp. 21-22.

Launching of the Atlas-Agena on February 26; unfortunately the second stage did not separate and the vehicle plunged to destruction 2,500 miles from Cape Canaveral into the Atlantic Ocean.



Lockheed's Agena-B, left, being prepared for a static test and above, on the handling trolley.

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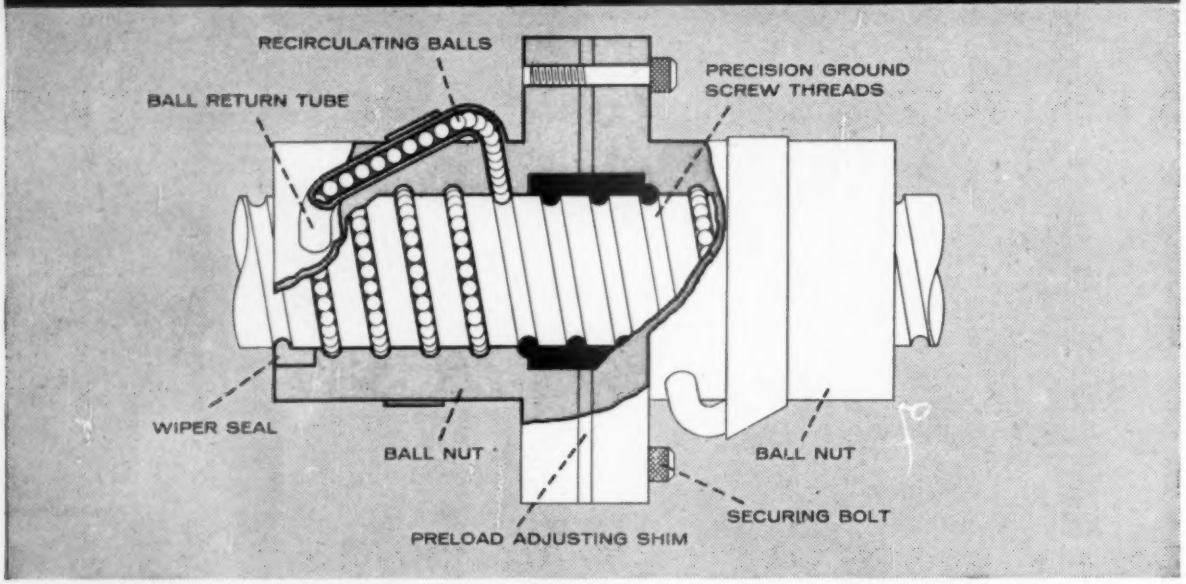

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BRISTOL SIDDELEY ENGINES LIMITED

Launching the Ballistic Deterrent

From Sea, Land, Air and Space

RELATIVE merits of the ground-based LRBM versus sea-borne and airborne ballistic missiles were discussed in London last week. The occasion was a lecture on "Ballistic Missiles and Space-Vehicles," given by Mr. G. K. C. Pardoe, project office manager of de Havilland Propellers, Ltd., at the Northampton College of Advanced Technology, London, on March 1.

Voicing his personal criticism of the "many misleading things that had been said recently about the capability of ballistic missiles and submarine- and aircraft-launched deterrent systems," Mr. Pardoe said there were two basic requirements for a true deterrent system. First, it must be incapable of being damaged or destroyed by conventional weapons. Secondly, it must be capable of delivering *some* nuclear retaliation after being subjected to a nuclear attack.

The lecturer considered that a land-based ballistic missile, fired from sites hardened against nuclear assault, offered the best solution to the deterrent problem as presently conceived. Disadvantages of alternative systems had, he thought, been glossed over by critics in the past few weeks.

One of the most glib recommendations in favour of submarine-launched ballistic missiles or air-launched ballistic missiles had been the advantage of mobility. Mobility in itself was useless unless it satisfied the basic requirements of a deterrent system.

Submarines themselves were vulnerable to conventional weapon attack. Imagine 10 nuclear submarines cruising on standing patrol and reporting back to base at regular intervals. Suddenly there are only nine, one having either hit a rock or been destroyed by an enemy hunter submarine.

Clearly, one would not start a nuclear war of retribution on the basis of an unknown reason for the loss of a submarine. There might even be a simultaneous conventional weapon attack by hunter submarines, on the whole fleet of missile-launching submarines; and it would be logical to suppose that such an attack would precede the launching of a salvo of ballistic missiles from enemy territory.

A system is as strong as its weakest link, the lecturer emphasized, and in the case of submarines not only must they position themselves with extreme accuracy when launching missiles but they must also receive communications instructing them what to do. This communication link is in itself extremely vulnerable as there are limited ways in which suitable, reliable, signals may be passed over long distances to a submarine when above or below the surface.

Mr. Pardoe said he did not suggest that the Polaris system was not extremely valuable, and it could well be supplementary to alternative deterrent systems based on stronger premises. However, in his opinion, the Polaris system was not a substitute for a true deterrent system.

Of the air-launched ballistic missile, the bomber which carries the ALBM is vulnerable to attack, first on its airfield and then, assuming it can be airborne at the time of hostile assault, in the air before launching its missile.

Here again, the launching procedure is not as simple as sometimes suggested. The aircraft must be located with great precision, and effectively stabilized, in order to launch an accurate attack, and once more, if we presuppose the aircraft to be airborne before the actual explosion of nuclear weapons on our territory, it will be subject to communication problems. Mr. Pardoe suggested that the vulnerability of the ALBM, together with the complications of multiple systems of aircraft and missiles, again weakened its case as a primary deterrent.

The lecturer next considered the cost and deployment policy of both the submarine system and the aircraft system. In the case of the submarine, there were many eggs in the basket and very few baskets at that! It had been said that the cost of a nuclear submarine with 16 Polaris missiles aboard would be approximately £70 million. Clearly there could not be too many of these roaming the sea; and the cost of supporting submarines from the point of view of servicing bases and crews, etc., would be extremely large compared with land bases using fixed sites.

The air-launched ballistic missile, Mr. Pardoe thought, is almost in the category of a pipe-dream at the moment, since nothing of a comparable nature has even been achieved with respect to the size of vehicle to be carried, and the accuracies and techniques to be developed.

"It is extraordinary," he said, "how anxious certain people are to welcome the glamorous unknown and yet turn their backs on well-advanced and tried and demonstrated systems under development."

Turning finally to the land-based hardened deterrent system, the speaker stressed that it satisfies the first requirement that it cannot be destroyed by conventional weapons.

The basic philosophy associated with the deterrent system is the degree of risk which an aggressor must take when launching a nuclear attack on another country. The number of ballistic missiles launched must greatly exceed the number of bases to which they are directed for reasons of reliability, accuracy, etc. A salvo attack may destroy a considerable number of the hardened land-based deterrent missiles, but a few at least would survive and these could be most effective. A certain number of the retaliatory missiles would reach their targets and the number to so complete their mission gives the measure of the risk which an aggressor must take in contemplating all-out nuclear war.

Even if *one* defending missile gets through it may well destroy the nerve centre of the country. The number of sites to survive would depend on the reliability of each missile in its system, the accuracy with which it can be delivered, the degree of hardness against enemy nuclear attack to which our launching sites are built and, last but not least, the number of defending deterrent sites which are constructed—and which the aggressor knows about. He must, therefore, be *certain* of the answers to *all* of these points before he can be sure that there is no risk associated with the attack, Mr. Pardoe said.

Of the development of space flight, the speaker thought that the communications satellite was an object of some interest. The most obvious possibility was the establishment of a pattern of satellites which would enable radio and television relay to be achieved, thus opening up commercial prospects.

On the military side, communications again had a high priority, but one could conceive applications of reconnaissance and surveillance from comparatively low altitudes around the Earth. Although there had hitherto been little serious talk so far of orbital combat, there had been suggestions that bombardment vehicles carrying nuclear warheads could be established in orbit and brought down when desired, thus forming yet another version of a deterrent system.

An early two-stage ALBM test-vehicle, the Martin WS-199B, forerunner of the Douglas GAM-87A Skybolt, goes aloft beneath the fuselage of a B-47.

A Scientist's Views on Space Research

SURVEYING the whole spectrum of space research and exploration, Professor A. C. B. Lovell, O.B.E., F.R.S., in his lecture, "The Exploration of Space," on February 24, dealt with the research being carried out with artificial satellites, space probes and radio-telescopes and the revolutionary new opportunities these techniques gave to our further understanding of the Universe. He was speaking before the Royal Society of Arts in London.

On the subject of the Van Allen radiation belts, their discovery, he said, had demonstrated that the Earth exerted a major influence on the interplanetary medium to a distance of more than 100 times that which had been assessed from purely Earth-bound investigations. It was now a reasonable assumption that other planets were surrounded by similarly trapped belts of radiation. If a major planet, like Jupiter, with 11 times Earth's radius and 318 times its mass, had a commensurate magnetic field, then the trapped radiation around it must be very extensive.

Dealing with the experiments made with the Jodrell Bank radio telescope in "bouncing" radio signals from the Moon, Prof. Lovell played a recording of music and speech transmitted by this method between the U.K. and the United States which was of quite remarkable quality. The Moon-bounce technique was a form of long-distance radio communication which could be carried out on wavelengths which were not susceptible to ionospheric or other terrestrial disturbances and Prof. Lovell agreed that there was probably a commercial future in these techniques.

The United States, he said, was hoping to launch 100-ft. dia. inflatable satellites for the purposes of voice transmission experiments and if sufficient were injected, we should have a series of artificial reflectors. Active repeater satellites were also being considered. It was probable that the future would see a commercial revolution in the transmission of trans-oceanic speech and information.

Later, the lecturer played a recording of the last few minutes of the telemetered signals from Lunik II before it struck the Moon. During this period, it had been possible to determine the probe's acceleration and also seek a measurement of the Moon's magnetic field, which had proved negative.

In conclusion, Prof. Lovell made a strong plea that exploration of the planets by means of space-probes should not be made indiscriminately for purposes of showmanship. Unless the utmost care is exercised, he said, these space vehicles may well contaminate the planets and their atmospheres with macromolecules which have developed on Earth. The intentional or accidental excursion of a probe into the environment of Mars or Venus before the biological instruments were ready might destroy for ever the value of the biological investigations and might, indeed, divert or destroy the evolutionary processes already at work in these domains.

It was also important, he thought, that space exploration should be promoted for peaceful purposes only. It was an innocent mind which did not see how the space probes and the radio telescopes had emerged from the cataclysm of war and that today they remain close relations of the defensive devices of nations.

"The danger," he said, "is not that the aspects of research which I have discussed will lack support, but that they will be supported extravagantly for the wrong purposes. The devices of the scientist who is concerned with the exploration of outer space are double-edged. It would be an inconceivable disaster if they are built up and organized in such a way that they can too readily be switched in support of national jingoism at this crucial moment of the inquiry into the fundamental nature of life and the Universe."

Answering questions, Prof. Lovell said that the Jodrell Bank radio-telescope would be used in conjunction with the American 100-ft. inflatable satellite, soon to be launched, at least on the first few orbits.

While sympathizing with the lecturer's concern for the peaceful development of spaceflight, Dr. W. F. Hilton of Hawker Siddeley recalled amusingly that even Galileo had leaned heavily on military resources by using cannon-balls in his classical experiment with gravity.

Home for Astronauts

A FULL-SIZE 62-ft. model of an Astronomical Space Observatory specially designed by the Douglas Aircraft Company, has a place of honour in the *Daily Mail* Ideal Home Exhibition which is being held at Olympia from March 1-26. The object of this Douglas exercise was to determine how four men could be carried into orbit at 300 miles to make astronomical, astrophysical and meteorological observations. The station would be supplied with a relief crew and provisions at intervals of 30 days by ferry rocket.

Although the scheme is an independent Douglas design, the company suggested to the exhibition organizers that they might get "a local engine manufacturer" to supply a mock-up of the engines. They turned to Bristol Siddeley who were immediately interested and treated the scheme with the seriousness they normally reserve for more realistic "hardware." The result is that they are now convinced that a practical liquid oxygen-liquid hydrogen power unit can be built in this country on the basis of the wide experience which is now available with cryogenic propellents.

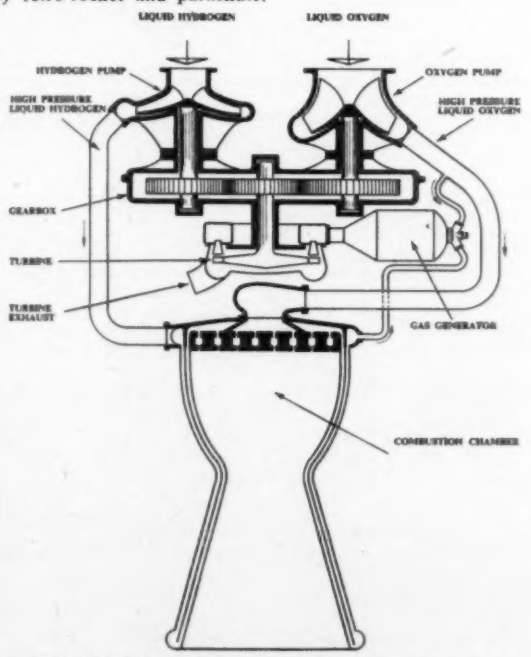
The outcome of Bristol Siddeley deliberations was an engine designed on the basis of a four-chamber unit of 100,000 lb. s.t., similar in principle to the Black Knight's Bristol Siddeley Gamma power unit but using liquid oxygen and liquid hydrogen. This was considered superior to a single gimbal-mounted thrust unit from the control viewpoint, and the tubular structure which formed the basis of the space-station provided an excellent thrust transmission member.

Intended to operate entirely in space, the second-stage engine would be started simultaneously with the shut down of the lower boost stage which was assumed to have a similar four-chamber layout but with a thrust of 450,000 lb.

The top stage is designed to develop full thrust within eight seconds of starting, whereupon full thrust is maintained for three minutes: the engine is then throttled back to about half-thrust for a further six minutes. An important feature of the Bristol Siddeley scheme is that until a precise orbit is attained, the engine is not completely closed down; this ensures that inertial forces cause the propellents to cover the tank outlet pipes in an otherwise "weightless" condition.

Another unique feature of the station's design—this time a Douglas innovation—is that once the propellents in the main tank have been consumed, the tank can be transformed into habitable quarters for the crew by mounting various items of equipment in prepared positions. It is this portion of the exhibit that one can enter to inspect the control and electronic arrangements, supplied by Smiths Aircraft Instruments and Mullard.

Four large panels intended to house solar cells hinge out from the centre of the station to intercept the Sun's radiation and so energize the space-borne electronics. At the extreme nose of the vehicle is a three-finned re-entry vehicle which can be detached in emergency with the crew and returned to Earth by retro-rocket and parachute.



Bristol Siddeley concept of a LOX/hydrogen thrust unit.

AS A FULLY-INTEGRATED WEAPON...

Everything connected with the flying and the operating of the ENGLISH ELECTRIC Lightning was designed and developed as a co-ordinated system. The airframe, the engines, the radar equipment, the electronic aids, the armament, the fire control devices—all were planned from the start to make the Lightning safe for its pilot, and deadly for its target.

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Aviation News in General

EGYPTIAN MIG 19s.—Czechoslovakian-built Mig 19s are expected to be delivered to the Egyptian Air Force in the very near future. They will be the first supersonic fighters in any Middle East air force and will also be the first Mig 19s in any air force outside Russia and her satellite countries. The Egyptian Air Force already operates Mig 17s and Il 28s, and the Syrian Air Force also has Mig 17s.

AUSTER ORDER.—A further contract for the supply of A.O.P. 9s to the Services has been placed with Auster Aircraft, Ltd. The effect of this order will be to ensure full employment at the company's, works over the next two years.

ETHIOPIAN SAFIRS.—A further batch of 10 SAAB Safir 91Cs has been delivered to the Imperial Ethiopian Air Force, bringing its total strength of this type to 42. The Safir is at present the standard primary military trainer in Sweden, Finland, Norway and Ethiopia.

SIKORSKYS FOR JAPAN.—The Japanese Self Defence Forces have ordered four more Sikorsky S-58s for naval use. The Japanese Navy now has four of these craft and the Japanese Coast Guards two.

FOR EXECUTIVES.—Pan American is planning to set up a subsidiary company to lease aircraft, crew training facilities and other services to companies requiring executive aircraft. The plan includes the purchase of 15-20 JetStars early in 1961, at about $1.2 million each with executive interiors.

CANADAIR HOURS.—To date the Canadair CL-44 turboprop transport has accumulated 50 hr. in 30 flights since its maiden flight in November. The CL-41 basic jet trainer has now done 24 hr. in 26 flights; and the first production Canadair 540 has totalled 30 hr. in 20 flights.

GAZELLE PROGRESS.—An A.R.B. special category approval has been awarded to the Napier Gazelle Mk. 500 for use in helicopters. This follows an M.o.S. type test taken in November, 1959; a full certification will not be awarded until further supplementary A.R.B. tests have been passed.

CESSNA - MAX HOLSTE.—On February 16 an agreement was concluded between Avions Max Holste and Cessna Aircraft Co. whereby Cessna has obtained a minority interest in Max Holste. The agreement provides for Cessna to represent Max Holste in the U.S.A. and Canada, and to help sell Max Holste products throughout the World. Both companies have the right to produce the other's aircraft, and in particular Cessna is interested in building the Super Broussard in the U.S.A.

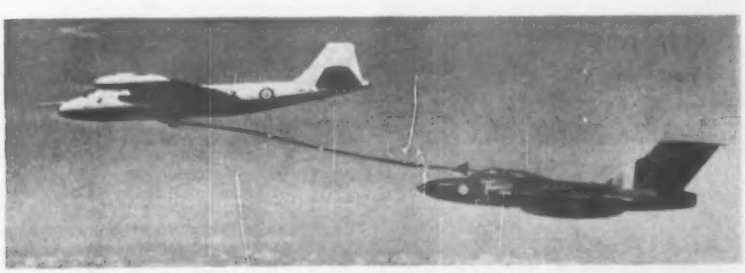
AIRBORNE MINESWEEPER.—A Sikorsky S-60 Skycrane, fitted with a special pod and winch, towing lightweight minesweeper gear. The helicopter can carry, lower, tow and retrieve the gear, making it a self-contained minesweeper.

GLIDING AWARDS

Annual awards and trophies for best performances of 1959 have been announced by the British Gliding Association: they will be presented at the Annual Ball tonight, March 11. They are:—

Frank Foster Trophy to Col. A. J. Deane-Drummond for fastest speed round a 100-km. triangle—43 m.p.h. Manio Cup and Wakefield Trophy to Cdr. Nicholas Goodhart, R.N., for best goal flight and longest distance —360 miles from Lasham to Portmoak, Scotland. De Havilland Cup to Philip Wills, for 17,900 ft. gain of height.

California in England Trophy to Mrs. Anne Burns for best woman's performance — 282 miles from Lasham. Seager Cup, for the best two-seater performance, to D. M. Kave and E. T. Martin for a 288-mile flight from Camphill to near Exeter. Douglas Trophy to the Army Gliding Club for the highest aggregate of three flights—193, 205 and 198 miles by Col. A. J. Deane-Drummond, Capt. E. G. Shephard and D. J. Corbett respectively.



FLIGHT REFUELLING.—An R.A.F. Javelin undertaking a trial air-to-air refuelling operation with a Canberra as tanker aircraft.

ATLAS MISHAP.—An Atlas ICBM exploded on the launching pad at Vandenberg A.F.B. on March 5 during fuelling operations.

SCOUT TEST.—A novel micrometeorite detector may be flown in a Scout test-satellite later this year, according to NASA. Device will consist of short metal tubes of varying thickness containing gas under pressure. When a tube is punctured, the pressure-drop will cause radio signals to be sent to Earth.

VERONIQUE ALOFT.—A Veronique upper-air research rocket was recently launched from the Colomb-Bechar test range in the Sahara to a height of about 125 miles.

RE-ENTRY SHIELD.—An insulated double-wall structure for the protection of space-vehicles re-entering the Earth's atmosphere is being developed by the Bell Aircraft Corp. under a $1,400,000 contract. The outer wall is a radiation shield consisting of expanding metal plates and the inner wall has tubes for circulating a liquid coolant. Thermal insulation completes the "sandwich."

SKY "EYE."—A joint project for a balloon-borne astronomical observatory is being developed by the U.S. Office of Naval Research, the National Science Foundation and NASA. A telescope fitted with a TV camera will observe stars from an altitude of about 20 miles.

LIFE IN SPACE?—A long-range search for evidence of life-like substances in space will be carried out by unmanned satellites and space probes, according to NASA.

NA.39 SELECTION.—Goodyear wheels, brakes, tyres and anti-skid equipment have been chosen for production NA.39s for the Royal Navy. The brake is of the full-circle double-disc type. The hydraulic brake control system for the Goodyear equipment is designed and produced by Electro-Hydraulics.

FOR SPORTSMEN.—The annual Sports Car Number of our associated weekly journal *The Motor* is to be published next Wednesday, March 16.

Commercial Aviation Affairs

BOEING SERVICE.—B.O.A.C. now hopes to start services with the modified Boeing 707s in June (at least two months after the original schedule). This new date assumes that the A.R.B. will approve, without further delay, the modifications now incorporated on the first 707-436. Plans are for three services a week to New York at first, plus one a week to Montreal and Toronto. By mid-August there will be 11 services a week to the U.S. and four to Canada, in addition to 21 Comet services and 27 Britannia services, offering nearly 6,000 seats in each direction.

POOL AGREEMENT. — The Australian Government has ratified the agreement between Qantas, B.O.A.C. and Air India for the pooling of services over routes between Australia, Britain and the Far East, and certain transatlantic services. The agreement is to come into effect on April 1.

FINNISH CARAVELLE.—The first of three Caravelles for Finnair was handed over at Toulouse on February 21. The company proposes to introduce Caravelles on its London service on April 18.

A.T.C. NOMENCLATURE. — The F.A.A. has renamed its air traffic communications stations. They will be known as flight service stations (FSS) or international flight service stations (IFSS) in future.

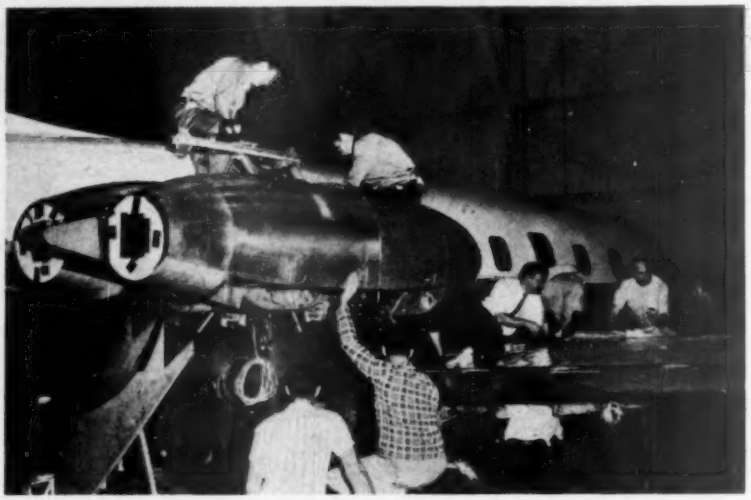
T.C.A. PLAN.—From June 1, T.C.A. will offer more than 1,500 seats a week across the Atlantic in each direction. A daily DC-8 service over the route London - Montreal - Toronto - Winnipeg - Vancouver will provide 127 seats, supplemented by eight Super Constellation services. From March 1, the latter will seat eight first- and 74 economy-class passengers.

SOUTHERN AIS.—The Civil AIS Area Centre at Uxbridge will close on March 27, and its functions will be transferred to the London Airport AIS Centre, which will then be renamed Southern AIS Centre, London Airport.

SEPARATION. — I.A.T.A. is recommending new separation standards. Aircraft with precision pressure altimeters or precision altimeters with servo-correction should be allowed 1,000 ft. vertical separation above 29,000 ft. in controlled airspace. The common pressure altimeter should permit 1,000 ft. separations up to 29,000 ft. Flight level indicators, based on the principle of a constant pressure interval, may make smaller separation possible eventually.

PLAN FOR YEADON.—The Leeds-Bradford Joint Airport Committee has approved a £400,000 development scheme which involves demolishing all the existing buildings and erecting new ones farther away from the two runways. The scheme will take three years to complete.

NEW SERVICES.—Approval has been granted by the M.o.A. for the following services: Lydd or Manston to Ostend, by Silver City (March to September) until March, 1967, and an all-freight service, Southend - Hamburg - Gothenburg, by Tradair, until the end of this year.



JETSTAR FOUR.—The Lockheed JetStar prototype, which has been flying for more than two years with two Bristol Siddeley Orpheus engines, is being fitted with four 3,000 lb.s.t. Pratt & Whitney JT-12s. Other modifications for production JetStars include leading-edge flaps and twin main and nose wheels.

BAGINTON'S FIRST.—Work has now started on the construction of a 5,400-ft. runway at Coventry's municipal aerodrome at Baginton. It is expected to be completed by September.

BRANIFF BOOST.—Pratt & Whitney JT4A turbojets in the four Braniff 707-220s will be modified during their third major overhaul to increase the rated power from 15,800 lb. to 17,800 lb.

DC-8 SERVICE.—Pan American Airways has announced its intention of using its DC-8Cs alongside Boeing 707 Intercontinentals on the North Atlantic routes through London, starting in April.

GERMAN BOEINGS. — The four Boeing 720s recently ordered by Lufthansa are designated 720B-030 and will seat up to 130 passengers. The first Conway-engined 707-430 for Lufthansa was to arrive in Hamburg on March 3, followed by another in March, the third in April, fourth in September and fifth next year. Services start on April 1.

T.A.A. IN LONDON.—Mr. Douglas Laurie (left), Trans-Australian Airlines U.K. manager for the past five years, has been succeeded by Mr. R. Meeham. During his period in this country, Mr. Laurie has handled the purchase of more than £10 million-worth of British aircraft.

NO MEALS.—From April 1, B.E.A. and Air France will discontinue all meals and bar service on their tourist flights between London and Paris. Fares are being reduced from £16 6s. to £14 19s. return and from £11 19s. to £9 19s. for night flights.

NO MANIFEST?—Among more than 50 recommendations submitted to the 76 member governments of ICAO by its Air Transport Committee are the elimination of the passenger manifest, simplification of the aircraft's general declaration and elimination of visas for tourists and temporary visitors.

ALL-GERMAN D.L.H.—From April 1, the West German Lufthansa will have only German flight personnel. Lufthansa employs about 200 pilots, and German nationals have been trained for these posts at the airline's pilot training school.

BUSY WASHINGTON. — During 1959 movements at Washington National Airport averaged one every 100 seconds, with a total of 313,418. The peak was reached on June 10, when there were 1,205 operations, an average of one every 72 seconds for 24 hours. Just over five million passengers used the airport, and airline movements totalled 249,414, second only in the U.S. to Chicago Midway, where there were 345,170 airline movements in 1959.

B.O.A.C. APPOINTMENT. — Mr. Frank Collier has been appointed B.O.A.C. manager, London Station. He succeeds Mr. C. H. Bizzell, whose assistant he has been since March, 1953. He will be in charge of nearly 1,000 staff working at London Airport North and Airways Terminal.

AIR CEYLON CHAIRMAN.—Mr. P. Nadesan, former director of civil aviation in Ceylon, has been appointed chairman of the Air Ceylon Board. Mr. J. L. M. Fernando, who has been acting chairman, will remain in his post as general manager.

Personal Flying

BEECHCRAFT'S new Model 65 Queen Air six-seat executive transport recently achieved an altitude of 35,400 ft. in an attack on the height record for Class C.1.d aircraft weighing between 1,750 kg. and 3,000 kg. The prototype Queen Air (N110Q), flown by Beech test pilot James D. Webber, was in standard form for the attempt, although weighing only 5,649 lb. of its maximum 7,700 lb. all-up weight for take-off, to meet the class requirements.

Subject to F.A.I. confirmation, the flight will exceed the 30,361-ft. record established on July 5, 1957, by Miss Jerrie Cobb in an Aero Commander 680-S. The Queen Air is powered by two 340-b.h.p. Lycoming IGSO-480-A1A6 supercharged fuel-injection engines, and has a maximum speed of 239 m.p.h. The luxuriously appointed four-five-seat cabin is entered by a downward-hinging door incorporating its own air-stairs. Production Queen Airs (or should it be Queens Air?) are now being operated by the U.S. Army, the Federal Aviation Agency, and the Japanese Government.

• • •

An amphibious version of the Piper Comanche is being developed by the Edo Corporation. A 250-b.h.p. version, N888Z, has been fitted with twin 289-2700 amphibious floats, incorporating dual tandem retractable wheels. The normal Hartzell airscrew has been replaced by a full-feathering type of 83-in. diameter.

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In view of the possibility of the petrol tax rebate concession (which halves the price per gallon) being withdrawn from flying groups in the near future, the P.F.A. is circulating its members for them to bring this state of affairs to the notice of their M.P.s. The loss of this tax rebate will immediately increase flying rates by at least 20%, and as most P.F.A. members fly on a fixed monetary budget, aircraft utilization will fall, resulting in still higher rates.

Increased costs, in turn, will seriously affect the feasibility of the plan to see all private aircraft eventually radio equipped, to fit them into the general traffic pattern. Interference with this scheme can only prejudice air safety.

ALL FOR STYLE.—Styling rather than aerodynamics has dictated the swept fins of the 1960 Cessna range, represented here by the 31 OD. This luxurious twin also has a new "non-congealing" oil cooler.

Gliding Notes

by Dr. A. E. Slater

IF you want a sailing holiday on the Norfolk Broads, you hire a wherry or something, and live in it. The equivalent in gliding terms is being demonstrated in the shape of a hireable glider and trailer —only you don't bed down in the glider, but in the trailer, which becomes a caravan as soon as it has been emptied of the glider.

The caravan is a bit longer than an Olympia's wing, 26½ ft., and is beautifully fitted up, with four bunks convertible into settees, cooking facilities, heat and light, lots of locker space, crockery and bedding —in fact, all you have to provide yourself is food and a towing car. The width of the trailer, 5 ft., is a little more than that of the average glider trailer, to make room for the folding bunks as well as the thickness of two wings and a fuselage (one wing-tip fits under the cooking range).

Since you and the glider cannot both occupy the trailer at night, enough waterproof glass-fibre cloth is provided to cover the glider fully rigged, with plenty of overlap where the various sections join at the wing-fuselage junction. There are stout picketing devices for holding the wings horizontal and keeping the tail on the ground, and Mr. Hall, founder of Soaring Holidays, Ltd., whom you cannot catch out with awkward questions, has satisfied himself from the best aerodynamic advice that it will not blow away in a 40-knot surface wind gusting up to 25% above average.

The sailplane is an Olympia 2b, one of the latest batch made by Elliotts of Newbury, with extra refinements, fully instrumented, and with parachute and barograph. All the firm's Olympias are to have white wings, but each fuselage will be a different colour. The firm's name will not be displayed on it, so you can pass it off as your own (like a hired Rolls-Royce) as you go round visiting your gliding friends.

So long as you operate from recognized gliding centres, and do not bungy the machine off from untried hills, you pay only the minimum charge, which is at present fixed at 40 guineas per week. So, if there are four of you, that is 10 guineas each plus food, petrol, and any launching fees. This certainly compares favourably with other holiday sports where you have to hire the equipment.

An extra premium must be paid for launching from other than regular sites, for taking the outfit abroad (only because of increased risk on the roads, not the air), or for competition flying. You must, in any case, satisfy the firm as to your flying skill. Mr. Hall is, of course, inevitably asked about crashery; he replies that the machine is comprehensively insured, but you pay the first £20 for a flying accident, £10 for damage on the ground, and £5 for damage on the road.

* * *

IMPERIAL College Gliding Club was only a day out in celebrating its 30th anniversary with this year's Annual Dinner on Feb. 26, for the first entry in the Minutes Book, the secretary told me, was dated Feb. 25, 1930. Lorne Welch, speaking for the guests, began instructing the club's pupils 13 years ago without, he said, knowing anything about instructing. He attributed part of the club's success to its backing by Authority; his only regret was that it had not produced even more good ideas, and he hoped it would do so in the next 30 years. However, Ken Machin, proposing the club's health, said it had produced two of the greatest technical men in gliding today—Dick Scorer and Frank Irving.

The club, in looking for a new training site, considered the Oxford Club's site at Weston-on-the-Green, but found it was too far off in time, rather than distance, owing to the congested main road. In the interval some aero-tows are being done at Redhill, its earlier site, with the club's Eagle and Skylark 2. The famous "Daisy," of T-21 type, has been sold to Lasham after doing over 35,000 launches, spending 3,160 hours in the air, and being pushed by hand for at least 2,000 miles, Irving estimated. A commemorative painting of the machine, done by Ann Welch, was presented to the Rector, for possible hanging in the Junior Common Room.

* * *

IN a gap between a cold front which had passed over in the early morning, and an approaching warm front which arrived soon after midnight from the S.W., two clubs found excellent waves on Feb. 27.

At the Derbyshire and Lancashire Club, Michael Kaye reached 11,300 ft. in a Skylark 2, and three others about 5,000 ft. At the Yorkshire Club David Carrow, on a visit from Lasham with a Swallow, reached 9,000 ft., and David Hill, in the club Swallow, 8,800 ft. at which height he had to fly at 50 kt. to remain stationary; both went off down wind, landing at Ampleforth and Easingwold respectively. A visitor from the Newcastle Club, Mr. Garlick, reached 6,000 ft.

* * *

WINNERS of the Annual Awards and Trophies, presented at the Annual B.G.A. Ball on March 11 will be found on the News pages.

Correspondence

From Air Cdre. R. H. S. Spaight, C.B.E., R.A.F. (Retd.)

More R.A.F. Cricket?

I NOTICE that the memorandum by the Secretary of State for Air which accompanies the Air Estimates says that more candidates of good quality are needed both for aircrew entry and for the cadet entry to Cranwell.

A potent factor in attracting young men from schools is prowess in games. In recent years the R.A.F. has tended to neglect this aspect. For instance, the R.A.F. cricket team, apart from one or two officers, has consisted of young professionals doing their National Service. No encouragement has been given by senior officers to the Adastrian Cricket Club which is the breeding ground for Service representatives. As a result there are too few colourful personalities in R.A.F. sport today to invite hero worship from the young. This affects recruiting adversely.

Also too few opportunities are given to the young men who are in the Service to equip and qualify themselves through the Adastrians to play for the Service.

If senior officers now in the Service gave a little more attention to this matter, not only would they improve recruitment but also the general goodwill towards the R.A.F.

Finchampstead, Berks. R. H. S. SPAIGHT.

Manpowered Flight—By Airship?

MR. HENRY KREMER has generously offered £5,000 for a prize for the first successful manpowered flight. Now what are the motives prompting this? Surely that manpowered flight offers a chance of freedom, adventure and possibilities of travel to the masses.

Manpowered flight, however, with a heavier than air craft promises to be one long slog with no relief. Why have the organizers prohibited a lighter than air craft and the use of lighter than air gases? (See THE AEROPLANE AND ASTRONAUTICS for Feb. 5.)

A small airship that could be propelled at 15 m.p.h. by one man would surely provide a much more enjoyable ride.

Those who have ballooned are delighted with the experience. But a balloon is too uncontrollable; a small amount of manpower to control direction is desirable although travel would be down wind in general. Rests would be possible frequently.

If a rest is taken in a heavier than air craft height will be lost rapidly as minimum drag will be the criterion and not minimum L/D ratio. (A high lift/drag ratio can be obtained on a glider almost regardless of size.) This loss of height must be made up by greater effort later. The only relief will be obtained when rising air is encountered and this does not occur when wanted. Gliders do not often reach the set objective. It is thought that a manpowered airship might.

Hessle, E. Yorks A. H. CRAWSHAW.

Early Autogiros—Information Wanted

FOR several years I have been endeavouring to locate technical information on Cierva's Autogiros, particularly on the C.30 and C.40 types, I am writing in the hope that you may be able to assist me.

From the available literature, it would seem that the amazing potential of the gyroplane was never fully realized, its final development being curtailed by the last War. In an effort to prove this point, I am seeking data, from an historical point of view, concerning the performance, handling, mechanical design, etc., of the C.30 and C.40 types.

Only one Autogiro seems to be in existence in Australia, and this no longer in a flyable condition. It is a C.30 of Avro manufacture, now serving as a museum-piece in the local Royal Aero Club.

Sydney, N.S.W. J. BLACKLER B.E.(AERO.).

[Our correspondent will find much of what he wants in Jane's All the World's Aircraft for 1934 and subsequent issues. Copies of this annual should be available in reference libraries.—ED.]

Cranwell Apprentices—Proposed Reunion

YOU will be aware that Lord Trenchard's reorganization of the Royal Air Force after the 1914-1918 War included the technical training of apprentices; in fact the first and second entries by competitive examination joined the Service at Cranwell in February and September, 1920.

These Cranwell-trained apprentices were certainly the prototypes of the many thousands who, ever since, have formed the technical background of the Royal Air Force.

A number of people who joined No. 2 School of Technical Training in 1920 think it appropriate that the 40th anniversary should be marked by a reunion dinner in London during May.

Eligible ex-apprentices and instructional staff interested in such a reunion should write in the first instance to Air Cdre. H. E. Nowell, C.B., O.B.E., Norwich House, 4 Dunraven Street, Park Lane, London, W.1.

Hatfield, Herts. R. C. GRINTER.

From Air Vice-Marshal Peter Wykeham, D.S.O., O.B.E., D.F.C., A.F.C., R.A.F.

A Great Brazilian Pioneer

I AM working on a biography of M. Alberto Santos-Dumont, the well-known Brazilian aeronaut. The details of his aircraft and his aviation exploits can be procured by means of research available to me, but his life outside the aviation world is more obscure.

I would be most grateful if any of your readers who may have biographical material, letters, or first or second-hand reminiscences, could get in touch with me at the address below. Any written material lent would, of course, be scrupulously preserved and returned, and appropriate acknowledgment made.

R.A.F., Upavon, Wilts. PETER WYKEHAM.

Groundabout

The MOA We Are Together—2

The mergeritis now afflicting so many of the industry's executives is well illustrated by the heart-cry from one of them to his secretary: "I have to go out for half an hour. If the boss rings up—GET HIS NAME!"

*

Keats foresaw the whole thing:

"O what can ail thee, knights at arms,
Hard pressed and palely loitering . . . ?"
"Pale warriors, death-pale are they all—
They cry 'LA BELLE DAME SANDYS MERCY HATH US IN THRALL!'"

*

I'll Believe Anything. This, I'm told, actually happened at R.A.F. Marham: During a snowstorm, the Controller on duty in the A.T.C. caravan alongside the main runway heard a knock on the door. He opened it, and there was a motorist who said: "Excuse me, is this the road to Swaffham?"

*

Manpowered Flight

"Damn—I suppose that'll disqualify me under Regulation 4.1.5."

Extract 4.1.5. from the R.Ae.S. regulations for the Kremer Competition for Manpowered Flight: "No part of the machine shall be jettisoned during any part of the flight including take-off."

*

Gimmickmanship. These airline P.R.O.s will go to any lengths, or, as in the case of Delta Air Lines, any depths, to bang the drum. To christen their first Convair 880, a Miss San Diego, presumably dressed appropriately in a swim-suit, used "a bottle of mixed waters gathered from 60 of the oceans, lakes, rivers, creeks, springs and reservoirs along the airline's routes." However, help is on the way for the poor publicity chaps—an American (of all people) has invented a pseudo-champagne bottle containing a liquid which froths madly when the bottle is broken.

by Lorenzo

Industry Record

U.S.A.F. Control Contract

Five radar controllers are being employed by the U.S.A.F. at Wheelus A.F.B., Libya, under contract with International Aeradio, Ltd., which operates the Tripoli Approach Control for the Libyan Government. The five controllers are former R.A.F. personnel and have had experience at Idris and elsewhere in I.A.L.'s large area of operations.

All have been employed to work directly for the 633rd Aircraft Control and Warning Squadron in providing increased assistance from Wheelus to the Idris Control Centre. The voice circuit between the two airfields is constantly available for the transmission of radar information.

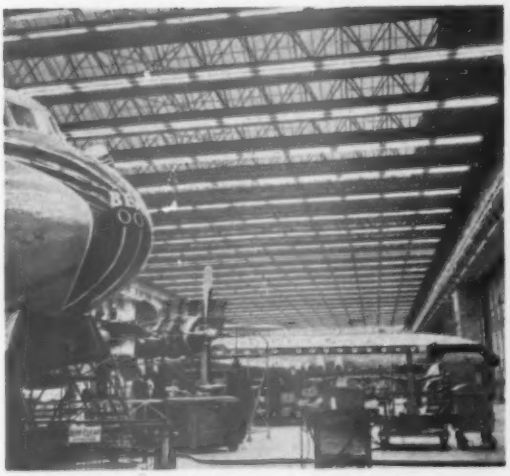
As explained by the U.S.A.F. squadron commander and the operations officer, the new system will not only expedite military aircraft approaches and departures but will be a significant aid to Libya in the field of air navigational aids and air traffic control.

Light-alloy Production

A rolling mill, thought to be the largest of its type in Western Europe, has been ordered by James Booth Aluminium, Ltd., as the first part of its £5 million re-equipment and expansion programme. It is expected to be in operation in the company's Kitts Green Works, Birmingham, during 1961.

The mechanical side of the new plant, costing approximately £1½ million, has been ordered from Loewy Engineering Co., Ltd., and is designed to roll aluminium and Duralumin slab ingots weighing up to 6 tons, for the production of plate, sheet and strip. Included in the plant is a 12-ft. 4-in. wide reversing hot mill.

As well as providing much larger sizes of aluminium-alloy plate, particularly to meet the growing demands of the shipbuilding, chemical, aircraft and atomic energy industries, the new plant will greatly augment the production capacity for all flat rolled products. The maximum sizes that it can handle are 50 ft. in length, 12 ft. in width and 5 in. thick.



One of the new maintenance hangars recently completed at the B.E.A. engineering base at London Airport. The cold cathode lighting in the roof was supplied by The General Electric Co., Ltd.

B.E.A. are to use Wanner grease guns for maintenance on their new Vickers Vanguards. Manufactured by Step Industrial Equipment, Ltd., of Berkhamsted, the guns have been supplied with two-way connectors to fit button-head grease nipples.

New S.I.M.A. Members

One of the latest firms to be elected to the Scientific Instrument Manufacturers' Association of Great Britain is K.D.G. Instruments, Ltd., of Crawley, Sussex, manufacturers of measuring, indicating, and recording instruments principally in the field of pressure liquid level, and temperature. The total S.I.M.A. membership is now 173, comprising 145 full-member firms, and 28 associate-member firms.

Selling in the States

An agreement aimed at greatly increasing the sale of British-designed electronic equipment in the United States has been announced. Under it the Fairbanks Whitney Corpn. of New York, whose Group manufactured products include aircraft engine accessories and missile components, undertakes to market most of the range of electronic equipment designed and manufactured by E.M.I. Electronics, Ltd.

Among the products of E.M.I. Electronics that will now be fully exploited in the U.S. market are its computers and data processing systems, analogue computers, scientific and industrial instruments, electronic control and automation systems, and closed-circuit television. In addition to the full-scale sales drive for E.M.I. equipment in the United States, Fairbanks Whitney will also manufacture some of the British company's equipment under licence.

Titanium Bolt Developments

Reductions in the price of titanium-alloy bolts have been announced by Guest, Keen and Nettlefolds (Midlands), Ltd. Largest in the smaller diameters, such as 10-32 UNF, ¼ in. and ⅜ in., these reductions have been brought about by the company's development of improved processing methods coupled with price reductions in the cost of titanium bar by Imperial Chemical Industries.

Instead of quoting examples of costs, say, per 100 bolts, the company says that it is of more practical value to quote the cost per pound weight saved compared with mild-steel bolts. Even with the maximum discount for quantity, this cost could have been in the region of £40 to £50 per pound weight saved, depending on diameters selected.

Now, using ¼-in.-dia. bolts as an example, this cost has been reduced to the region of £24 to £26 per pound

L.A.P. Fuel Delivery

Pipeline delivery of aviation fuel to London Airport is planned to start this month with the opening of two Shell-Mex and B.P. pipelines from Walton to two storage points at the airport. Hitherto road tankers have fed L.A.P. from the Shell-Mex and B.P. storages at Purfleet and Shell Haven, in the Thames Estuary.

At first, aviation turbine fuel will be delivered into storage at the Walton depot, which is on the south side of the Thames, from Shell-Mex and B.P.'s installation at Hamble, in Southampton Water. Later in the year it is planned to provide also for the piping of supplies to Walton from Kent Refinery, near the mouth of the Thames, along the 65-mile Government pipeline built during the War.

This pipeline, which runs south of London from the Isle of Grain to Walton, is now being renovated and transportation along it will be charged to Shell-Mex and B.P. by the Government.

The company's twin pipelines run roughly north-west from the Walton depot. After 6½ miles, they enter the airport perimeter at the southern corner and branch into two main pipelines and one spur line. (A feature story on this installation appeared in THE AEROPLANE for Dec. 5, 1958.)

The two main pipelines continue for 2¼ miles across Runway No. 5 to the million-gallon storage depot at Perry Oaks, Shell-Mex and B.P.'s main storage point, on the western perimeter of L.A.P. Supplies are pumped from Perry Oaks under two main runways to the company's central area depot; from here fuelling vehicles deliver to aircraft.

The spur pipeline from Walton follows the airport perimeter north-east to the maintenance area depot, which was designed for delivery mainly to aircraft undergoing maintenance. Pumping along the pipelines will be controlled initially by a private telephone system linking Walton, Perry Oaks and the maintenance area depots.

Over the year a daily average of 40 tankers, the largest with a capacity of 4,000 gallons, have been needed for the 80-100-mile round trips to the airport and back. At peak periods during the summer 60 tankers a day were required to meet the heavy fuel demand from holiday passenger aircraft. Initially, the new pipelines will carry fuel at about 30,000 gallons an hour.

Industry Record . . . .

weight saved. In the case of some popular length bolts in larger diameters, it has been reduced to the figure of £17 10s. per pound weight saved.

Although it can be expected that these reductions will greatly stimulate demand, it is unlikely that further reductions of this magnitude will follow in the near future.

Comprehensive tests have been undertaken by a number of aircraft manufacturers in the past two years and, although trials have been made in a number of alloys, every British production order has been in material to specification I.C.I. 314A, containing 4% aluminium and 4% manganese. In view of the amount of work which has been undertaken on this material, it is likely to remain the standard for some years to come.

The S.B.A.C. has recently issued standard A.S.1. (Hexagon Titanium Bolts) and A.S.2. (Countersunk Titanium Slotted Bolts) which replace the previous necessity to refer to general standards such as B.S. A25 and the like. In order to cater for special requirements, G.K.N. (Midlands) are developing the production of 12-point head bolts for tension loads, as well as countersunk bolts with Phillips recess heads.

New Spark Intensity Indicator

Lexor Electronics, Ltd., of Coventry, are now manufacturing a spark intensity indicator based on an original design by R.A.E. Farnborough. Developed to measure and compare spark levels, its principal applications in the aeronautical field are the testing, maintenance and adjustment of aircraft generators and motors.

Incorporating a sensitive valve voltmeter, the instrument indicates a very wide range of sparking levels and can easily be calibrated to suit particular applications. Models are available for permanent installation for continuous monitoring in connection with maintenance and safety schemes. The instrument will indicate sparking not normally visible, such as on the underside of brush-gear, and on equipment undergoing tests in an altitude chamber.

The console desk in the ArmstrongWhitworth 650 Argosy fitted with a strip recorder for providing a permanent record of temperature variations in the aircraft. The instrument, known as the ElectroniK, measures the heat distribution in various systems and components. It was supplied by Honeywell Controls, Ltd.

PUBLICATIONS RECEIVED

Fighter Command.—A study of air defence from 1914 to 1960. By Peter Wykeham. 320 pp.; 5¼ in. by 8¼ in. Illustrated. Putnam and Co., Ltd. Price 30s.

Jahrbuch der Luftfahrtforschung, 1959.—The yearbook of the German aircraft industry. Edited by Forschungszentrum der Luftfahrtindustrie. 128 pp.; 8¼ in. by 11¼ in. Illustrated. Price DM. 14.

Oil is Where They Find It.—An authentic story of the lives, adventures, skill and enterprise of men who travel the World serving the oil industry. By Edward Ward. 255 pp.; 5¼ in. by 8¼ in. Illustrated. Harrap and Co., Ltd. Price 15s.

Small Gas Turbines and Free-piston Engines.—A survey of gas-turbines ranging from the smallest to about 1,500 b.h.p. with emphasis on the medium-output engines. By Arthur W. Judge. 328 pp.; 5¼ in. by 8¼ in. Illustrated. Chapman and Hall. Price 48s.

Aviation Calendar

March 14

London.—British Institution of Radio Engineers Radar Group discussion on "Short Range Navigational Aids," at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.1, at 18.30 hrs.

March 15

Glasgow.—R.Ae.S. Glasgow Branch lecture, "Lessons Learned from Aircraft Accidents," by J. G. M. Pardoe, at the Royal College of Science and Technology, at 19.15 hrs.

London.—R.Ae.S. lecture, "Some Problems of Separated and Vortex Flows," by Prof. H. B. Squire, in the Library, 4 Hamilton Place, W.1, at 19.00 hrs.

Salford.—Royal Technical College lecture, "Long Range Missiles," by A. K. Weaver, at the Royal Technical College, at 19.00 hrs.

March 16

Christchurch.—R.Ae.S. Christchurch Branch lecture, "Lighter than Air Aircraft," by the Rt. Hon. Lord Ventry, at the King's Arms Hotel, at 19.30 hrs.

Coventry.—R.Ae.S. Coventry Branch lecture, "The Hovercraft," by G. H. Elsey, in the Herbert Art Gallery, at 19.30 hrs.

London.—Royal United Service Institution lecture, "Rockets, Satellites and Military Thinking," by Sir Frederick Brundrett, at the Institution, Whitehall, S.W.1, at 15.00 hrs.

Southampton.—R.Ae.S. Southampton Branch 7th Mitchell Memorial lecture by D. Keith-Lucas in the Engineering Lecture Theatre, University of Southampton, at 10.00 hrs.

March 17

Cowes.—R.Ae.S. I.o.W. Branch lecture, "Hovercraft," by C. S. Cockerell, in the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, at 18.00 hrs.

London.—R.Ae.S. Main lecture, "Supersonic Aircraft—Promise and Problems," by M. B. Morgan, at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1, at 18.00 hrs.

March 18

London.—Institute of Navigation lecture, "The American Air Traffic Control Programme," by Hans Giesecke at the Royal Geographical Society, 1 Kensington Gore, S.W.7, at 17.15 hrs.

London.—R.Ae.S. Agricultural Aviation Group film evening, in the Library, 4 Hamilton Place, W.1, at 19.00 hrs.

Company Notices

NEW COMPANIES

Associated Flying and Motor Club, Ltd. (644,811).—Private co. Reg. December 17. Cap. £1,000 in £1 shs. Directors are: Donald G. Bennett and Gwynneth M. Bennett, both of 51 Porth-y-Castell, Barry. Reg. office: 5 Fitzalan Road, Cardiff.

Dextrair, Ltd. (648,479).—Private co. Reg. February 2. Cap. £100 in £1 shs. Objects: To carry on the business of shipping, forwarding commission manufacturers and general agents, maintainers and operators of shipping, air, transport and road transport services. Directors: John S. E. Hector, Cherry Tree Cottage, Marlow Road, Bourne End, Bucks; James W. Martin, The Annexe, Upton Road, Chertsey, Surrey. Reg. off.: Cherry Tree Cottage, Marlow Road, Bourne End, Bucks.

Keegan Aviation, Ltd. (648,621).—Private co. Reg. February 3. Cap. £100 in £1 shs. Objects: To establish and operate air transport and ancillary and cognate services in the United Kingdom and elsewhere. Directors: Thomas D. Keegan and Wendela O. Keegan, both of Ashton House, Steeple Ashton, Trowbridge, Wilts. Sec.: Wendela O. Keegan. Solrs.: H. Maxwell Lewis, Southend. Reg. off.: 28 High Street, Southend-on-Sea, Essex.

Hunting Aerosurveys, Ltd. (649,363).—Private co. Reg. February 12. Cap. £100 in £1 shs. Directors: George S. Highcock, 13 Glenmere Avenue, Mill Hill, N.W.7.; Roy E. Treacher, 32 Nutfield Road, Coulsdon, Surrey. Sec.: G. S. Highcock. Reg. off.: 6 Elstree Way, Boreham Wood, Herts.

Skyscript, Ltd. (649,500).—Private co. Reg. February 15. Cap. £1,000 in £1 shs. Objects: To carry on the business of aerial publicity and advertising promoters, skywriters, etc. Directors: Donald I. Seymour, 35 Fitz James Avenue, W.14; Rufus Riseley, 7 Palace Mansions, Addison Bridge, W.14.; and Maurice V. Rose. Sec.: P. D. Byrne. Reg. off.: 109 Jermyn Street, S.W.1.

Steel Ring and Engineering Co., Ltd. (649,503).—Private co. Reg. February 15. Cap. £500 in £1 shs. Objects: To carry on the business of manufacturers of and dealers in steel goods, steel fabrications, rubber goods, aircraft, automobile and marine parts. Directors: Lawrence Cash, 56 Hamstead Hill, Handsworth Wood, Birmingham; Norman Cash, The Manor, Friary Road, Birmingham, 20.; Ronald Cash. Sec.: N. Cash. Solrs.: Tyndall Mirams and Co., Birmingham. Reg. off.: Horsley Heath, Tipton.

Air Condor, Ltd. (649,656).—Private co. Reg. February 16. Cap. £10,000 in £1 shs. Objects: To construct, equip, maintain works, purchase and let on hire aeroplanes and to carry on the business of carriers by air, etc. Subscribers (each with one share): Alan D. Sims, 31 Hillfoot Road, Collier Row, Romford, Essex; Arthur L. Pears, 6 Colchester Avenue, Manor Park, E.12. Directors: Royston W. Lea and Robert A. Short. Sols.: Constant and Constant, 24 St. Mary Axe, E.C.3.

Hardy Spicer Walterscheid, Ltd. (649,576).—Private co. Reg. February 16. Cap. £10,000 in £1 shs. Objects: To carry on the business of engineering in all its branches, etc. Subscribers (each with one share): Marion Wix and W. S. Clarke, both of 59-67 Gresham Street, E.C.2. Directors: Bernhard Walterscheid-Muller, Kurt Schroter, Herbert E. Hill, Michael S. Crosthwaite and John Corbett. Sols.: Linklaters and Paines, 59-67 Gresham Street, E.C.2.

CHANGES OF NAME

Manwood Miller and Co., Ltd. (356,676).—Manufacturers, vendors and repairers of aeroplanes, etc., Castle Stre t, Stalybridge, Cheshire. Name changed to Manw..d Miller Fans and Filters, Ltd., on September 22, 1959.

Saro-Nuclear Enterprises, Ltd. (619,746).—Osborne, East Cowes, I.o.W. Name changed to Saunders-Roe and Nuclear Enterprises, Ltd., on October 2, 1959.

Personal Notices

BIRTHS

Clayton.—On February 24, at R.A.F. Hospital, Ely, to Jill (*née* Short), wife of Flg. Off. Dudley Clayton—a daughter.

Hopkins.—On February 23, at Louth, to Jean (*née* Galton), wife of Flt. Lt. Brian Hopkins—a son.

MacRostie.—On February 24, at R.A.F. Hospital, Ely, to Enid (*née* Eaton), wife of Sqn. Ldr. J. S. MacRostie—a son.

Roberts.—On February 25, at R.A.F., Wegberg, Germany, to Joan, wife of Rev. (Sqn. Ldr.) Matthew Garnant Roberts—a son.

Sharp.—On February 17, at Jever, West Germany, to Ann (*née* Faux), wife of Flt. Lt. Eric Sharp—a son.

Wood.—On February 22, to Barbara (*née* Dunn), wife of Flt. Lt. F. R. Wood—a daughter.

DEATH

Coggle.—On January 16, Gp. Capt. Cyril Kenneth Joseph Coggle (Retd.).

'Flight' Photograph

PIONEER IN AFRICA. These Twin Pioneers are part of No. 21 Squadron, R.A.F., now out in East Africa. Specifically designed for liaison work, they do a score of jobs that a larger or faster aircraft could not tackle. One day they will fly supplies to a famine-stricken village. Next day, the job will be flying troops to a 400-yard airstrip, or photographing the country for a new survey. Or reconnaissance, or dropping a doctor by parachute to an urgent case.

Who says adventure has gone out of flying?

Battle of Britain veterans often talk about the old Spitfire days. Looking at today's sleek jets you might think that sort of flying had vanished for ever. Not a bit of it! All over the world, there's still plenty of what veterans call 'real flying'. And this will always go on in the Royal Air Force. Take the job of carrying in supplies; or flying out hospital cases; or search and rescue. The truth is that in the R.A.F. you've got to be able to handle many types of aircraft. Standards today for R.A.F. aircrew are higher than ever they've been. But if you are good enough, you'll lead a life any man might envy. Why not find out more?

The R.A.F. wants Pilots, Navigators and Air Electronics Officers. For details of how to apply, of pay, conditions and allowances, write to Group Captain J. N. Ogle, A.F.C., A.F.M., Air Ministry (AP 63), Adastral House, London, W.C.1. (Applicants must be between 17½ and their 26th birthday and have gained a good G.C.E. or equivalent.)

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- Flight test instrumentation.

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PROCTOR V, slightly damaged condition, namely, cracked main spar in centre section, airframe hours 12, engine hours 2b3, C. of A. to March 11, 1961. Offers to John H. F. Kenny, Erne House, Greystones, Co. Wicklow, Eire. 525-xx57

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APPLICATION NO. 3409 on the route Portsmouth and/or Shoreham-Cherbourg.

APPLICATION NO. 3410 for a seasonal service on the route Portsmouth and/or Shoreham-Dinard and/or La Baule, from May 1 to October 31 each year.

APPLICATION NO. 3411 on the route Portsmouth and/or Shoreham-Le Havre and/or Deauville.

FROM BRITISH EUROPEAN AIRWAYS CORPORATION OF BEALINE HOUSE, RUISLIP, MIDDX:—

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FROM SILVER CITY AIRWAYS, LTD., OF 62 BROMPTON ROAD, LONDON, S.W.3:—

APPLICATION NO. 3414 for a Normal Scheduled Service with Dakota aircraft for the carriage of passengers, supplementary freight and mail, between Leeds and Amsterdam, at an initial frequency of three return flights weekly increasing later to seven return flights weekly, for seven years from date of approval.

APPLICATION NO. 95/5 for an amendment to the terms of approval of the Normal Scheduled Services which they are authorized to operate with Dakota, Bristol 170 and Heron aircraft on the route Newcastle-Leeds (opt)-Brussels at a frequency of three return flights weekly until March 31, 1967, so as to enable them to operate on the amended route Newcastle and/or Leeds-Brussels and to integrate the service with their proposed U.K. Internal Service between Blackpool and Leeds (Application No. 3346) so as to enable them to operate on the route Blackpool-Leeds-Brussels.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 525-1

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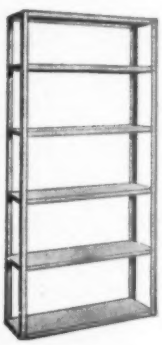

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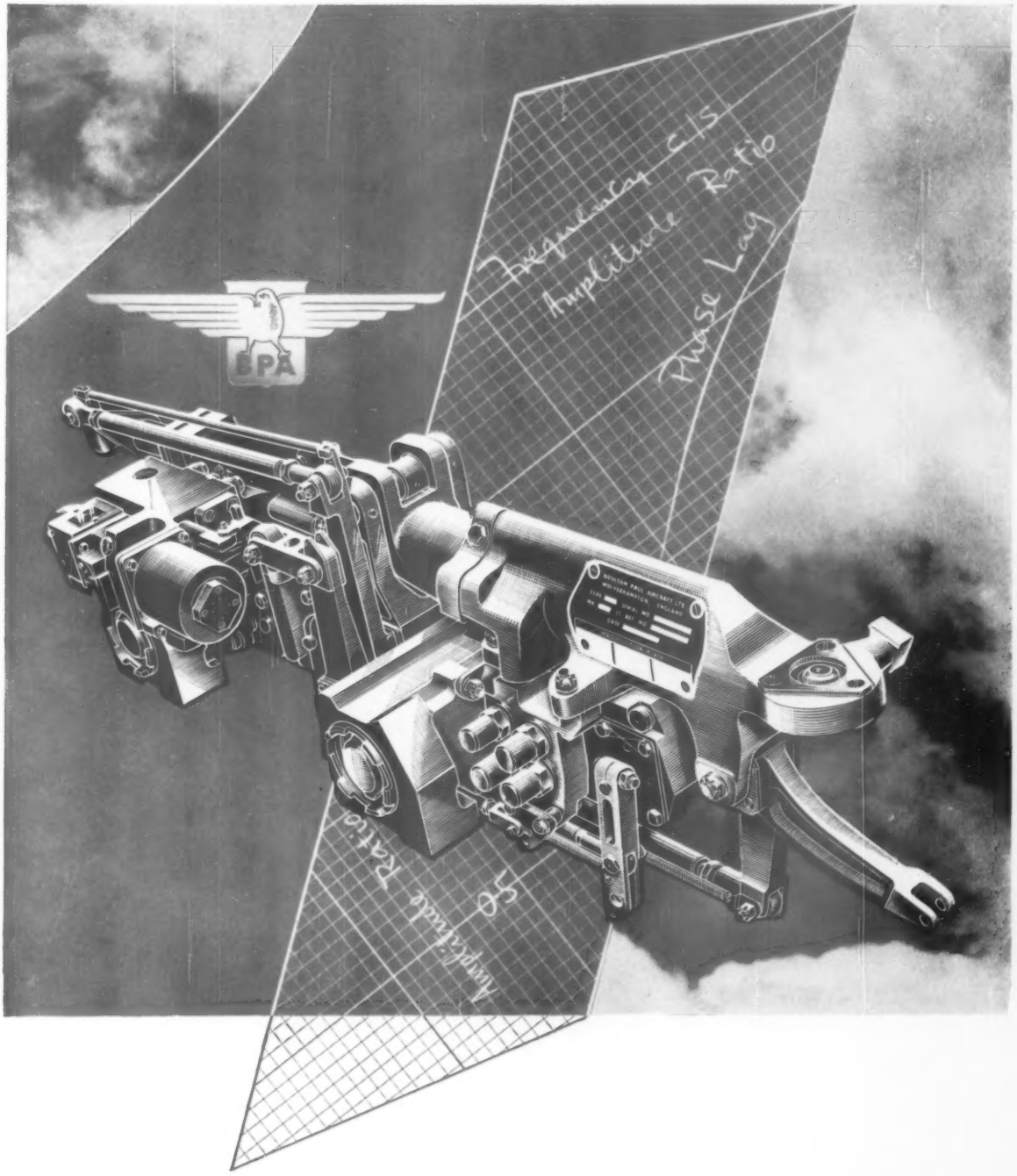

POWER CONTROLS

Rotary control valves incorporated in Boulton Paul powered flying control units ensure sensitivity and accurate response when operating in manual control or under autostabilizer and auto-pilot authority. Duplication of the NA.39 rudder unit shown in the illustration is achieved by using a tandem ram operated by separate hydraulic supplies to the two sides.

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P.C. 24

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